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TITLE Energy Action in Schools. Animated Bibliography. A Sample of Energy Education Curriculum Materials.

INSTITUTION California Energy Extension Service, Sacramento.

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NOTE 103p.; Prepared by the California Energy Extension Service. Several of the samples contain small print and may not reproduce well.

PUB TYPE Reference Materials - Bibliographies (131)

EDRS PRICE MF01/PC05 Plus Postage.

DESCRIPTORS Annotated Bibliographies; Audiovisual Aids; Books; Conservation Education; Elementary Secondary Education; *Energy; Energy Conservation; *Environmental Education; Instructional Materials; Learning Activities; Teaching Guides

IDENTIFIERS Energy Education; PF Project

ABSTRACT

Over 35 instructional materials suitable for use in an elementary and secondary level energy education program are cited in this annotated bibliography. Materials include story books, compilations of learning activities, audiovisual materials, student activity packets, and teacher's guides. Publication dates, when given, range from 1978 to 1981. For each citation, a brief review is accompanied by information concerning author, availability, price and grade level, and illustrations. For some materials, reproductions of resource pages are also included. (LP)

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Energy Action in Schools

Animated Bibliography

A Sample of Energy Education Curriculum Materials

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

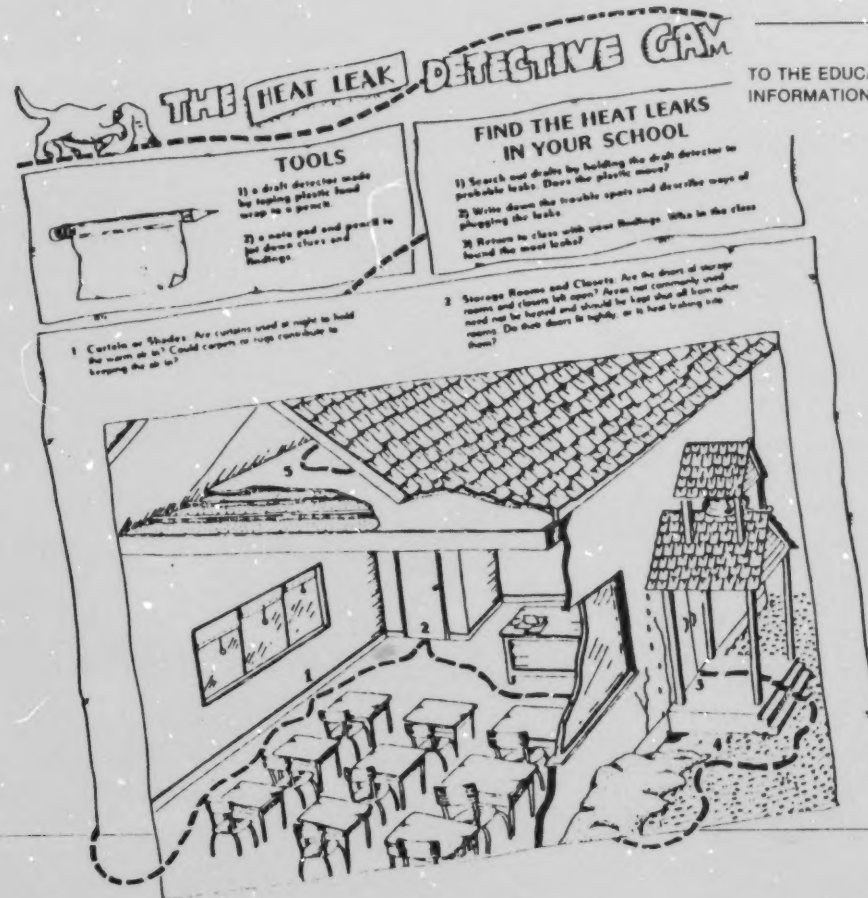
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California
Energy
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Energy Action in Schools

Energy Action In Schools
Office of Appropriate Technology
1600 Ninth Street, Suite 330
Sacramento, California 95814
(916) 323-4388

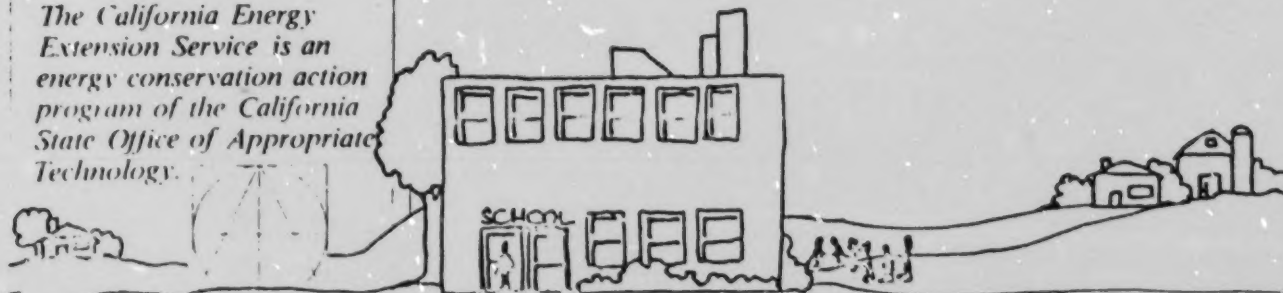
Staff:
Jan Philbin
Dickson Schwarzbach

Energy Action In Schools works with schools in the State of California to develop energy education programs which reduce school energy usage and costs by involving the school staff and students in energy management.

The Animated Bibliography was developed by:

Dana Stokes
Dickson Schwarzbach
Jan Philbin
Charlene Mathews
Tom Whitney
Carol Cook

The California Energy Extension Service is an energy conservation action program of the California State Office of Appropriate Technology.



Energy Action in Schools

K-Adult

WHAT MAKES EVERYTHING GO

By Michael Elsohn Ross, 1979

Story book; Grades K-Adult

Available from:

Yosemite Natural History Association

P. O. Box 545

Yosemite National Park, CA 95389

(209) 372-4532

Cost: \$2.95

"What Makes Everything Go" is a charming book which describes energy basics for 1st-3rd graders (and children of all ages) through delightful illustrations and a clear text. The book covers what energy is, energy flow, energy transfer, energy resources and energy efficiency. An alligator, surrounded by his insect and animal friends, dramatically shows a curious young boy and girl about how energy functions in our environment.



If you use gas to make a car go,

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the gas will change to smoke and heat.



Can you take that smoke and heat and change it back to gas?

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K-12

RECYCLING ACTIVITIES FOR THE CLASSROOM

Selected and developed by Mary Lynn Bowman and Herbert L. Coon, 1978

Teacher Guide

Grades K-12; Science, Math, Social Studies, Language Arts, Fine Arts

Available from:

ERIC/SMEAC

1200 Chambers Road, Room 310

The Ohio State University

Columbus, Ohio 43213

(614) 422-6717

Cost: \$4.95

This action-oriented collection of activities shows students how to recycle, re-use and extend the use of everyday items. From monitoring the amount of paper, glass and metal discarded by their homes or schools to finding ways to use everything from old Christmas trees to empty milk cartons, this 137 page pamphlet offers teachers of all subjects and grade levels a wide variety of interesting and habit-changing ideas.



PURPOSE:	To investigate ways to use garbage.
LEVEL:	Elementary school
SUBJECT:	Fine Arts
CONCEPT:	The values held by a society determine what are resources and their economic worth.
REFERENCE:	Lund, Cherie, and Chanelle Wolfe. <u>Exploration with Garbage</u> . Project ECO-log. Highline Public Schools, Seattle, WA. Title III, ESEA. ED 132 008
ACTIVITY:	Ask students to bring from home yesterday's garbage.

Following is a list of some activities and art ideas that you can do with garbage. Your activities will depend upon what types of garbage you have. You and your class may think of different activities. Be sure to stress health and safety.

ACTIVITIES AND PROJECTS WITH GARBAGE

1. Put aside and clean and dry all bones. Try to reconstruct the animal using glue.
2. Mosaics and collages can be made from chips of egg shells, dried coffee grounds, or dried fruit peelings.
3. Egg cartons can be used for making caterpillars (remember to paint them a bright color!), trains, flowers, or anything else within the imagination of the group.
4. Using wasted paper towels from the lavatory or newspaper, one can make papier-mache. If light globes are in your garbage, they make excellent maracas after being papier-mached and broken.
5. If teacher wishes to explore the area of compost, garbage may be buried and dug up at a later date.
6. There are a variety of musical instruments that can be made from garbage:
 - a. coffee can bongos
 - b. can lid cymbals (make certain sharp edges are covered with tape)
 - c. musical bottles (put different amounts of water into bottles--hit with mallet to produce different sounds).

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7. Many exciting, creative things can be made from milk cartons of all sizes. (Before starting, wash and dry cartons thoroughly.)

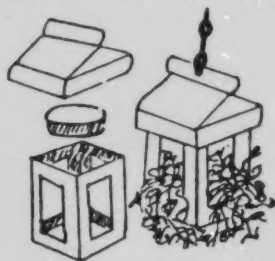
Cut any size milk carton to desired height. Cover the outside with cloth scraps--felt, velvet--even, printed cottons are easy to handle. Just overlap and glue. Self-adhesive papers work very well, come in attractive patterns and wipe clean.

What will it be? A pencil holder, a button box, a litter box for the car? Maybe a cachepot for your favorite plant. Turn a carton upside down, cover it with matching wallpaper scraps, and it's a spray can cover for all those aerosols in the kitchen, bath, and laundry.

Make a box--a sewing box, a jewelry box, a box for recipes or photographs.

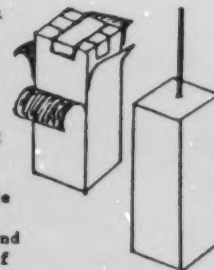
8. Hanging Planter

Cut the top from a half-gallon carton. Cut each corner down 1" from the top and bend back. Cut openings in four sides. For the roof, cut the gable from a gallon carton 3/4" from the gable line. Fit the two pieces together snugly and glue. Use plastic cup for the plant container. Your planter is ready to hang or use as an attractive table decoration.



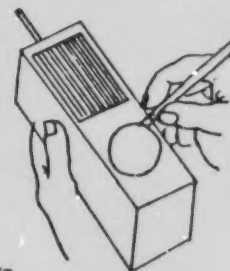
9. A Walkie-Talkie That Really Works

Cut the gables off two quart milk cartons. Cut two square pieces from a third carton to fit the opening and make a flat top for each carton. Seal on four sides with pressure-sensitive tape. Paint or cover with self-sticking paper.



Cut five slits 2 1/2" long, 1/8" wide and 1/4" apart. Start 1" from top of carton. This is where the sound comes out. Cut the bottoms out of two small drinking cups, leaving a 1/4" edge. These are the mouthpieces. Cut two circles near the bottom of the carton just large enough to hold the cups, leaving about 3/4" of the cup outside the carton.

Tie a knot in one end of a long, long string. Punch a small hole in the back of one carton opposite the mouthpiece just big enough for the string to slide through. Pull the string from the inside to the outside until it reaches the knotted end. Punch the same size hole in the other carton and thread the string from the outside to the inside. Tie a knot in the second end; pull string backwards until it is stopped by the knot.



Energy Action in Schools

K-3, 4-6

SPACESHIP SCHOOL ACTIVITY CARDS
Teacher's Guide & Student Activity
Sheets, 1981, limited number of
trial edition revised out in 1983
Grades K-3 and 4-6

Available from:

Marin County Office of Education
1111 Las Gallinas Avenue
San Rafael, CA 94903
Contact: Barbara Steinberg/
Sid Smith

(415) 499-5815

Cost: \$5.00 plus postage

This program focuses on teaching children the connections among earth's life systems. Students design and build their own spaceship which they must plan to live in for three years. In the process, they learn to make decisions and solve problems regarding energy, food, the environment, living creatures and mutual cooperation. Each packet consists of a set of approximately 40 spaceship activity cards which approach spaceship planning through a four stage process: quest, probe, star council and mission. A teacher's guide is also included.

QUEST:

FOOD

HUNT FOR RAGUS

★ Figure out what kinds of food we should take on Spaceship School. Start by finding out what we eat now.

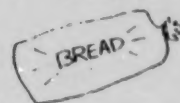
★ Get paper and pencil.

★ Interview 2 or 3 friends. Write down EVERYTHING they ate yesterday.

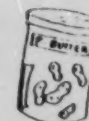
IMPORTANT!

★ Check the Chief Ragus Research Scientist Card to see what he says about the foods we eat.

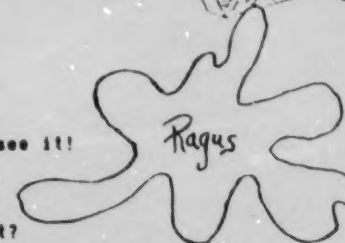
★ Circle the Ragus foods on your interview papers.



What's Ragus??



You eat it.
You drink it.
But you often can't see it!
Where is it?
What is it?
Can you figure it out?



Turn RAGUS around
And you'll have the right clue.
Now why might it be bad
For me and for you?

Our bodies need lots
Of things that are yummy.
But too much of some things
Makes us feel crummy!



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PROBE: _____ FOOD

NO RAGUS

Can you make something good to eat with no RAGUS in it?

You need:

- | | | | |
|------------------|----------------|-------------|------------------|
| -rolling pins | -spoons | -banana | -oil |
| -wax paper bags | -block of wood | -orange | -heavy cream |
| -jar and top | -salt | -bowl | -pineapple juice |
| -round-end knife | -peanuts | -can opener | -apple |

★Before you start, be sure to wash your hands!

#1 something

- ★Pour the cream into your jar and close tightly.
- ★Take turns shaking it.
- ★Keep shaking until the cream is part solid and part watery.

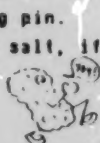
What do the two parts taste like?



#2 something

- ★Shell some peanuts and put them in a wax paper bag.
- ★Crush them with the rolling pin.
- ★Add a few drops of oil and salt, if you wish.

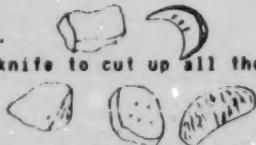
What have you made?



#3 something

- ★Peel the banana and orange.
- ★Use the block of wood and knife to cut up all the fruit into small pieces.
- ★Put it in the bowl.
- ★Add a little pineapple juice and stir.

Taste good?



How could you USE your left-overs?



STAR COUNCIL: _____ FOOD

RAGUS RATINGS

The Chief Ragus Research Scientist wants you to choose the crew's food for our journey.

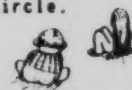


- ★Get the Ragus Rating Cards and sit in a circle.

Put them upside down. No peeking!

- ★Each person picks 5 cards.

Don't show them to anyone!



- ★Arrange your 5 food cards in order of IMPORTANCE.

- ★Share what order you chose and why.

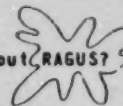
- ★Now put all the cards back in the circle.

- ★Work together to choose the 10 most important foods to take along.

MISSION: _____ FOOD

RAGUS REFORM

How can you let people know about RAGUS?



Here are some things to try:

- ★Go on a RAGUS hunt at home.

1. Look for RAGUS in the "ingredients" list on labels of cans and boxes.

2. Show your family which foods contain RAGUS. They may be surprised!

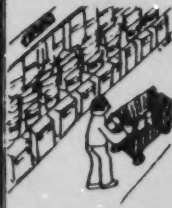


- ★Go on a supermarket search.

1. Read the "ingredients" list on the labels of some familiar foods.

2. Write down those foods that contain RAGUS.

3. Share what you find out with each other, your teacher and your family.



Energy Action in Schools

K-2, 3, 4, 5, 6

ENERGY CONSERVATION ACTIVITY PACKETS
(E.C.A.P.'s), 1980
Teacher's Guide and Student Worksheets
and Activities

Five books; Grades K-2,3,4,5,6

Available from:

Joan Overton

Instruction and Curriculum

Iowa Department of Public Instruction

Grimes Building

Des Moines, Iowa 50319

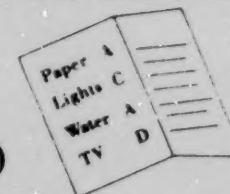
(515) 281-5839

Cost: \$2.50 each

This activity-oriented curriculum offers several lessons to exemplify each of the energy objectives outlined for grades K-6. Reproducible activity sheets with clear graphics make the lessons easy to use. Extensive annotated bibliographies are included for both students and teachers. This is an excellent resource for introducing students to: how they use energy, what energy resources are, and why they should use energy wisely.

Energy Activities
Grade 3
Packet "A"
Master #3
Activity A (2.2, 2.3), pg. 10

MY ENERGY REPORT CARD



Name _____	Need No Improvement	Need a Little Improvement	Need Lots of Improvement
Week _____			
<u>Ways I Save Energy in School</u>			
• Conserve paper			
• Conserve crayons			
• Conserve pencils			
• Conserve paper towels			
• Turn off lights if not being used			
• Other _____			
<u>Ways I Save Energy at Home</u>			
• Conserve food			
• Conserve water			
• Conserve _____ (Fill in other items students tend to waste)			
• Turn off lights when not being used			
• Turn off radio and TV when not in use			
• Keep doors and windows closed in cool or cold weather			
• Wear warmer clothes in cold weather so the temperature does not have to be so high			
• Other _____			

Energy Action in Schools

K-3, 4-6, 7-9, 10-12

ENVIRONMENTAL/EDUCATION GUIDE, 1981

Grades K-3, 4-6, 7-9, 10-12

Available from:

Rudy Schafer, Environmental/
Energy Education Program
State Office of Education
721 Capitol Mall
Sacramento, CA 95814

Cost: \$7.00/each or \$25.00/set

This interdisciplinary activity guide was written to provide curriculum and supporting materials to facilitate the infusion of environmental education into the entire K-12 instructional program. The primer is compatible with the County Supt. of Schools Course of Study. The project was contracted by the Alameda County Office of Education for the California Dept. of Education's Environmental/Energy Education Program. The Guide is organized by four areas of concern: natural environment, built environment, social institutions and decision making. Objectives are outlined for each area of concern, which then relate to specific classroom activities. A listing of available state resources and a brief bibliography are also included. This activity oriented wealth of material is a great resource to teachers in developing an environmental education unit or program.

MR. AND MS. MACHINE

DESCRIPTION

Students do physical exercises, observe and build simple machines, and discuss energy needs/usage for various tasks and occupations.

OBJECTIVE

C-1. To understand that continuing supplies of energy are essential for maintenance of life in both natural and built environments.

PURPOSE

To learn that we consume energy in our daily activities.

Time	Where
120 minute sessions	Classroom
Topics	Materials
Energy; energy resources	Top or gyroscope, empty thread spool, rubber band, toothpicks

LEAD-UP/PREPARATION

Examine how our bodies use and consume energy by doing the following (older students test pulse before and after):

- Count how many sit ups or push ups you can do before you're tired.
 - Stand, then bend knees half-way, and hold skiing pose until you're tired.
 - Count how many times you can hop on one foot until you're tired.
- Q: What part of you did the work in each exercise?
Q: Why couldn't you keep up each exercise forever?
Q: How did the working part of your body feel at the beginning? at the end?
Q: How did your pulse feel? Why?

ACTIVITY

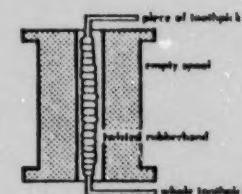
Step 1

Demonstrate a top or gyroscope (or collect several so the students can try them).

- Q: What is doing the work? What makes the top go around?
Q: Why does it stop?
Q: How could we make it go again?
Q: How did the top's movement change as we watched it?

Step 2

Have each student make a spool racer.



The racer's "engine" is a twisted rubberband.

Step 3

Discuss parts of body that "kinds" of activities or work use for different tasks.

- Simple, daily tasks like brushing teeth, taking out garbage, playing tag, etc.
- Occupations like being a dentist, use the mind, fingers, eyes, arms, back, etc.

Have students ask their parents what parts of their bodies get the most tired from the work they do each day at home or on the job. Perhaps make a simple interview sheet of class generated questions so class members will ask some questions of their parents as a homework assignment.

FOLLOW-UP

- Take a walk to look for evidence of animals and people doing work.
 - Take a walk to look at machines doing work for people.
- Q: What makes the machines go?
Q: Do they ever stop? Why?
Q: What would make them go again?

EE Guide, K-3

Energy Action in Schools

2

THE CAPTAIN POWER ENERGY EDUCATION PROGRAM

Teacher's Guide & Student Materials,
Grade 2

Available from:

Check with your utility company

Cost: Free from some utilities

Class Sets \$35.00

Class Replacement Packs \$28.00

For further information, contact

Energex Energy Education Programs
at (213) 420-6814

A complete teacher's program on energy for primary students. Seven stories are told about general energy misconceptions, but Captain Power always sets the record straight with her energy-basic facts. During this 3 week program students learn what appliances use the most energy and how to distinguish between essential energy needs and luxuries. An activity-oriented package, this can be plugged into any teacher's curriculum as is.



CAPTAIN POWER

CAPTAIN POWER ENERGY EDUCATION PROGRAM

Name _____

Understanding Energy

Energy Exercise 1.



For each question below, listen as it is read aloud. Then answer the question by drawing a circle around **Yes** or **No**.

Example. When we talk about energy, do we usually mean electricity and natural gas for our homes, and gasoline for our cars? ☒ Yes ☐ No

1. By "fossil fuels," do we mean oil, natural gas and coal? ☐ Yes ☐ No
2. Do we use energy when we cook our food? ☐ Yes ☐ No
3. Do we use energy to keep the inside of our refrigerators cold? ☐ Yes ☐ No
4. Do we use gasoline in our home heaters? ☐ Yes ☐ No
5. Are electricity and water the main kinds of energy we use in our homes? ☐ Yes ☐ No
6. Is oil made from gasoline? ☐ Yes ☐ No
7. Is supplying energy only a small business in most cities? ☐ Yes ☐ No
8. Do lots of people work at water and power companies? ☐ Yes ☐ No
9. Do the water and power companies know how much water and energy we use in our homes? ☐ Yes ☐ No
10. Are electricity and natural gas free? ☐ Yes ☐ No
11. Are there electric and natural gas meters at many of our homes? ☐ Yes ☐ No
12. Do electricity and natural gas cost most families more than food does every month? ☐ Yes ☐ No
13. Do we pay for electricity according to how much we use? ☐ Yes ☐ No
14. Do we have enough oil, coal and natural gas to last forever? ☐ Yes ☐ No
15. Does burning coal or oil to turn water into steam help make electricity? ☐ Yes ☐ No
16. Do we use lots of energy? ☐ Yes ☐ No

Energy Action in Schools

5

THE POWER QUIZ ENERGY EDUCATION PROGRAM, 1980

Teachers Guide, filmstrip, and several student materials

Grade 5

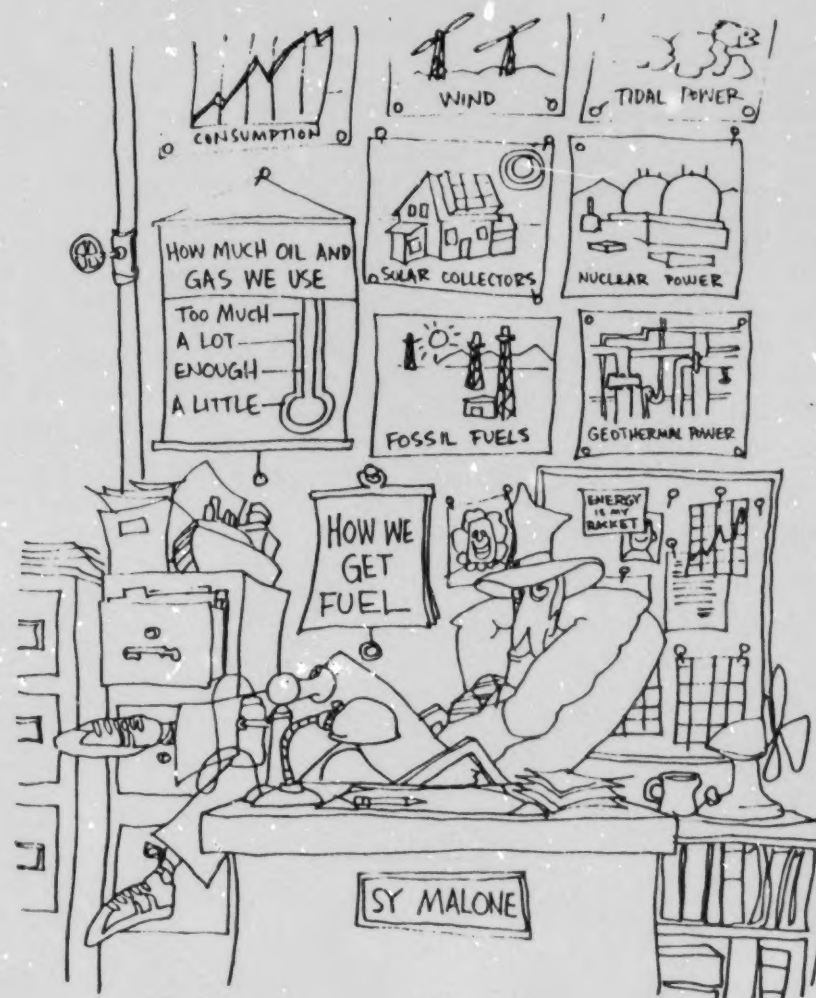
Available from:

Check with your utility company

Cost: Free from many utilities

The Power Quiz Energy Education Program is a complete energy unit for a fifth grade class. The unit is easy for requiring teachers use due to its flexible format. Fifteen lessons are included, requiring 20-30 minutes daily. Students receive a beautifully illustrated "pupil Practice Exercise Booklet" which gives them information on different energy sources, energy costs and the need to conserve fossil fuels. For further information, contact Energex Energy Education Programs at 213-420-6814.

Energy User	Yearly Cost Ranges		
	Low: Less than \$10	Medium: \$10 to \$50	High: More than \$50
1. Electric Range & Oven	☐	☐	☐
2. Electric Blanket	☐	☐	☐
3. Electric Blender	☐	☐	☐
4. Electric Clothes Dryer	☐	☐	☐
5. Gas Home Heater	☐	☐	☐
6. Record Player	☐	☐	☐



Energy Action in Schools

3

THE WIZARD OF WASTE ENVIRONMENTAL
EDUCATION PROGRAM, 1980
Self-contained curriculum set:
teacher's guide, filmstrip w/cassette
tape, poster, picture cards, pupil
booklets, badges, pre and post tests,
and take home leaflets.

Grade 3

Available from:

California Solid Waste Management
Board, Education Program
1020 Ninth Street, Suite 300
Sacramento, CA 95814
(916) 322-2650 or 2648

Cost: Free to California teachers

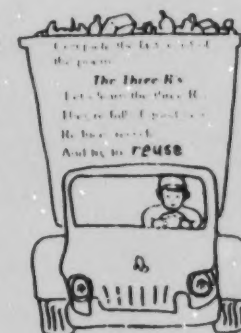
The Wizard of Waste Program is a two
week (10 activity) unit which intro-
duces the three R's, "Reduce, Reuse
and Recycle". Animated characters,
Dorothy and her friends, travel to
see the Wizard to find out what they
can do to reduce solid waste problems
in their community. The materials
are enjoyable for students, easy for
teachers to use, and show students what
"they can do" at home and at school to
lessen solid waste problems.

BEST COPY AVAILABLE

Practice Exercise 2

For each question below listen as it is read aloud.
Then circle YES or NO to answer the question.

1. Can many of the things we throw away be used again? YES NO
2. Can everything we throw away be recycled? YES NO
3. Is a recycled aluminum can as good as one made from new aluminum? YES NO
4. Does it take as much energy to recycle an aluminum can as it does to make a new one? YES NO
5. If a town has a transfer station, do fewer trucks have to go to the landfill? YES NO
6. Is litter solid waste that is on the ground and not in trash cans? YES NO
7. If you don't see a trash can, should you carry your trash until you find one? YES NO
8. Can too much solid waste pollute the environment? YES NO

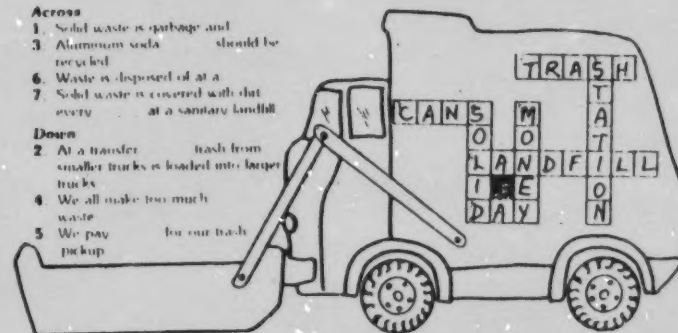


Across

1. Solid waste is garbage and
3. Aluminum soda should be recycled
6. Waste is disposed of at a
7. Solid waste is covered with dirt every at a sanitary landfill

Down

2. At a transfer trash from smaller trucks is loaded into larger trucks
4. We all make too much waste
5. We pay for our trash pickup



5

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6

THE TRASH MONSTER ENVIRONMENTAL EDUCATION PROGRAM, 1980

Self-contained curriculum set:
teacher's guide, pupil booklets, pre
and post tests, film strip and cas-
sette tape, natural resource cards,
stickers, and take-home leaflets.

Grade 6

Available from:

Solid Waste Management Board
Education Program
1020 Ninth Street, Suite 300
Sacramento, CA 95814
(916) 322-2650 or 2648

Cost: Free to California teachers

This two week (ten lesson) inter-
disciplinary unit introduces solid
waste concepts through comical fig-
ures who use serious facts. The
teacher-student materials are com-
plete, enjoyable for students, and
easy for teachers to use. Students
become aware of the problems of the
throw-away ethic and learn how they
can "reduce, reuse, recycle and
recover" natural resources.

Why is Solid Waste a Problem?

We are using up our natural resources.

1. Nature gives us natural resources. To make natural resources are used over and over again.



2. But people waste natural resources. They buy products and use them - then throw them away. The natural resources that the products are based on the landfill and lost forever.



We are polluting our environment.

3. Solid waste can be unsightly. It can end up as ugly litter.



4. Solid waste can be unhealthy. It can pollute our air and water.

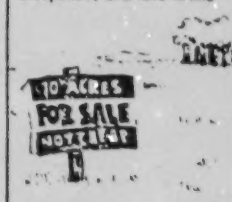


5. Solid waste can be unsafe. It can cause accidents and fires.



We are running out of nearby land for landfills.

6. A lot of land is needed for landfills. But land close to towns is expensive and hard to find.



7. So trash trucks must drive further to landfills. They take more time and gasoline.



8. Many people don't want landfills near their homes. So what do we do with our solid waste?



Lesson 4

6

Energy Action in Schools

1-6

CONSERVATION FOR CHILDREN

By Cupertino Union School District,
1979-80

Curriculum Guide, Grades 1-6

Available from:

Cupertino Union School District

Conservation for Children

6560 Hanover Drive

San Jose, CA 95129

(408) 725-8376

Cost: \$15.00 per guide

\$105.00 set of 7 guides

Each grade level guide contains 90 student worksheets (40 language arts, 20 math, 20 social studies and science, 10 related activities) which integrate conservation information and practice in the basic skills. The worksheets are intended for duplication by the teacher and can be used as a primary resource for teaching basic skills, supplementary materials to a core program, enrichment activities, skill review or as independent units of study. The program was designed with teachers in mind to provide them with materials to teach students about conservation without requiring additional time, money, or equipment.

Name _____

How Electricity Affects Our Lives

People began using electricity less than 100 years ago. Thomas Edison made the first practical electric light bulb in 1879. The electric motor was little used until the 1880s.

Today we have many electric appliances that help us around the house, entertain us, and make our lives easier. In 1900 very few homes had electricity. Those that did used it mainly for lighting. People cleaned their homes with brooms, mops, and dust cloths. They bought ice every few days to keep their food cold and fresh.

People in the United States today own many electric appliances, from big refrigerators and washing machines to small electric razors and can openers. Over 100,000,000 appliances a year are manufactured in the United States alone.

How does this affect our environment? Where do the materials come from to make the appliances? Where does the electricity to run the appliances come from?

DIRECTIONS: In the picture below, cross out the things that are wrong.

A PIONEER CABIN IN 1850

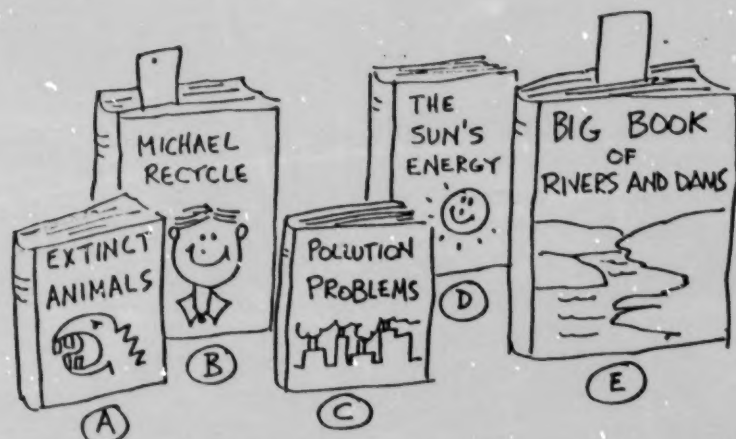


Level 5 Activity Guide

Energy Action in Schools

1-6

Name _____

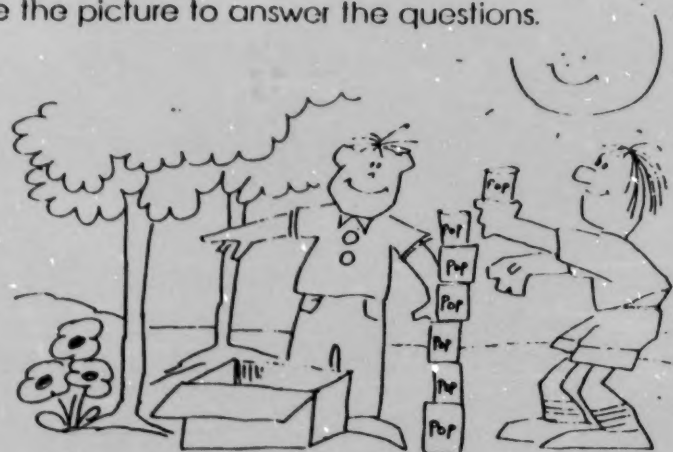


Directions: Write the letter of the book you would read to find the answers to the following questions.

1. How do you use old aluminum cans to make new ones? _____
2. What happened to the passenger pigeon? _____
3. What is solar power? _____
4. How are litter and trash spoiling our environment? _____
5. How do people use water to make electricity? _____
6. Where have all the dinosaurs gone? _____
7. How can old newspapers save our trees? _____
8. Why does smog hurt your eyes? _____

Level 3 Activity Guide

Jennifer and Mark are saving cans for recycling. Use the picture to answer the questions.



Directions: Circle the correct numeral.

- | | |
|-----------------------|-------|
| How many do you see? | 2 3 5 |
| How many do you see? | 4 6 7 |
| How many do you see? | 3 2 1 |
| How many do you see? | 5 1 2 |
| How many do you see? | 1 3 7 |
| How many do you see? | 5 6 3 |

Level 1 Activity Guide

Energy Action in Schools

5+

OUR ENERGY SOCIETY

A learning kit containing: a film strip and cassette tape; teacher guide; 14 individual activity cards and corresponding masters for duplication

Grades 5-9

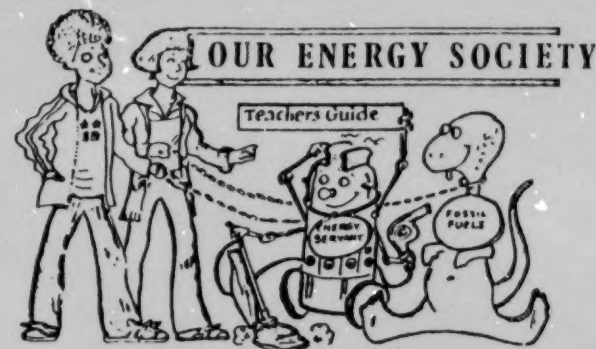
Available from:

Energy Planners & Evaluators
1386 Lake Valley Drive
Auburn, CA 95603
(916) 269-0723

Cost: \$55.00

(quantity discounts available)

"Our Energy Society" has been designed for easy use by the teacher, even for 9:00 a.m. Monday morning. Its major goal is to create an awareness of the huge energy expenditure needed to keep our modern society functioning and the need for conservation as a realistic way to give us the time to bring on line new energy sources.



SURVIVAL ENERGY THROUGHOUT HISTORY	OUR ENERGY SOCIETY				
	HUNTING-GATHERING PEOPLE	PRIMITIVE AGRICULTURAL PEOPLE	ADVANCED AGRICULTURAL PEOPLE	INDUSTRIAL PEOPLE	TECHNOLOGICAL PEOPLE
food preparation	burned wood to heat and cook	livestock feed for wood to cook	wood, coal	wood, coal, some oil	
shelter	very little. bark, leaves	some shelter for self and animals of skins, vegetation	stone, sod, wood houses	brick, wood, stone (very durable)	
industry & farming	made weapons & tools from sticks & stones	plow, sled, hoe	used water, wind power, iron tipped plow, horses, oxen	steam engine, disks, plane	
transportation	walked	walked or rode animals	rode animals, used wagons	horse, steam car	
	1 cup	2 cups	1-1/3 cups	3-4/5 cups	126 cups

Approximate energy "spent each day for each person to survive (in gasoline equivalents)"

Source: Cook, Earl, The Flow of Energy in an Industrial Society, Scientific American Magazine

Energy Action in Schools

7-8+

ENERGY 80, 1981
Teacher Guide and Student Guide
Grades 7-9

Available from:

ENERGY 80
1320 A
Santa Monica Mall #205
Santa Monica, CA 90401
(213) 394-9864

Order now to receive revised materials 82-3

Cost: No charge to CA teachers

The ENERGY 80 student guide is a masterful blend of exceptionally well written text and brilliant graphics. The 1981-82 version contains 16 two-page spreads, each addressing related but separate energy topics such as energy efficiency, energy resources, history of energy use and decision making about personal energy investments. The accompanying teacher guide: 1) provides background information which anticipates many of the issues that will come up in class, and suggests activities and discussion topics and 2) includes supplementary energy related activities. Next year a separate teacher guide for each of these functions will be available. When ordering indicate: 1) # of student guides and 2) # and type of teacher guide you will require.

Energy... rules of the game

Whenever we change energy from one form to another, part of the energy becomes heat. When you turn on a fan to cool yourself on a hot day, you don't want heat. You want to change electrical energy to the motion of air. But what happens? The electric motor gets hot. Part of the electricity is changing to heat.

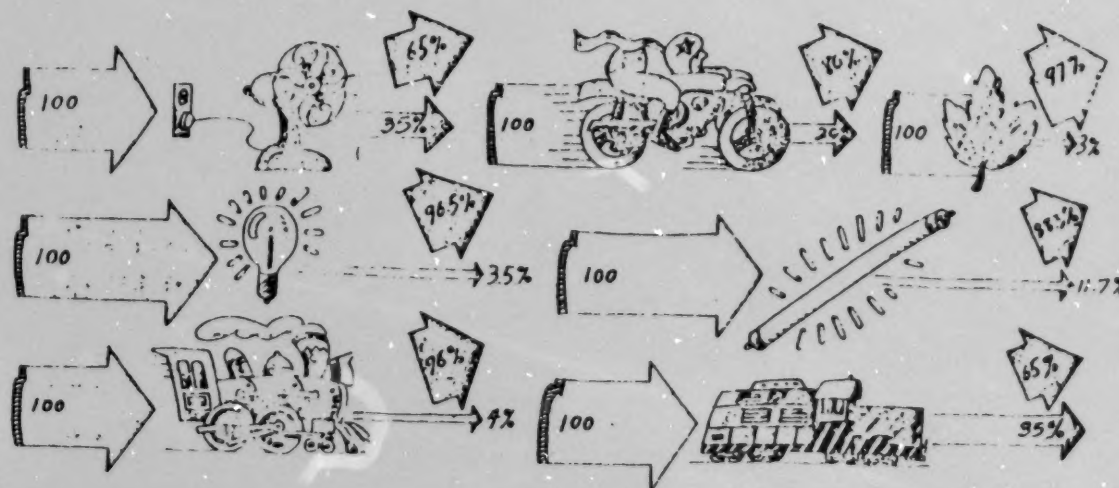
We want the chemical energy stored in gasoline to move the motorcycle. But a lot of the energy becomes heat in the exhaust or engine.

We want the light energy shining on a green leaf of corn to be stored as chemical energy in the plant. But most of it just warms the leaf. As time goes on, more and more of the energy in the universe gets changed to heat.

When we change energy from one form to another, only part of the energy we put in will come out in the form we want it. How much we can get is called efficiency. The efficiency of the fan motor is about 35%, of the motorcycle about 20%, of the leaf about 3%.

Inventors try to find more efficient ways of using energy. An incandescent bulb changes from 2.5% to 4.5% of the electrical energy it receives into visible light. 8.5% to 15% of the electricity entering a fluorescent lamp is changed to visible light.

Coal-burning steam locomotives had an efficiency as low as 4%. Modern diesel electrics have efficiencies of around 35%.



student booklet

Energy Action in Schools

K-12

ENERGY ACTIVITIES FOR THE CLASSROOM

Volume II, 1978

Teachers Guides

Grades K-12

Science, Math, Social Studies, Language

Arts, Fine Arts

Available from:

ERIC/SMEAC

1200 Chambers Road, Room 310

The Ohio State University

Columbus, Ohio 43213

(614) 422-6717

Cost: \$3.00

A sampler of classic energy activities from a variety of well known energy resource guides. An excellent resource for teachers who want to add energy activities to their classroom curriculum. Includes energy word finds, energy experiments, interpretation of energy data, discussing ideas on energy policy surveys of energy attitudes, etc.

PURPOSE: To compare fluorescent and incandescent lighting.

LEVEL: Junior High School

SUBJECTS: Science
Mathematics

CONCEPT: Energy is a fixed commodity being neither created nor destroyed but converted from one form to another. The means of conversion and the by-products of this conversion are important.

REFERENCE:

Michael Zamm and Barry C. Samuel. Energy Conservation Education: An Action Approach. Council on the Environment of New York City, 51 Chambers Street, Room 228, New York, NY 10007, 1977.

ACTIVITY:

Materials Needed:

Foot-candle meter
Appropriate desk-size wood or cardboard surface
40 W* fluorescent light
200 W* incandescent bulb

*W = watt

Show the class the demonstration apparatus. Ask the students if they know the names of the two different types of light bulbs. (Fluorescent and Incandescent.*)

*Fluorescent Lamp—a glass tube coated on the inside with a fluorescent substance that gives off light when activated.

*Incandescent Lamp—a lamp in which the light is produced by a filament of conducting material contained in a vacuum or gas and heated to incandescence by an electric current.

What type of bulb is being used for lighting our classroom?

Tell the class that you are going to demonstrate the amounts of light produced by fluorescent and incandescent bulbs on a surface.

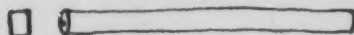
Using the materials shown in the following diagram, the students should see that a 40 W fluorescent bulb projects slightly more light on a surface at a distance of 8 ft. to 9 ft. (about 15 footcandles*) than a 200 W incandescent bulb (about 12 footcandles*).

*Footcandle—a unit for measuring illumination; it is equal to the amount of direct light thrown by one international candle on a square foot of surface every part of which is one foot away.

Energy Action in Schools

Fluorescent vs. Incandescent Lighting

outlet



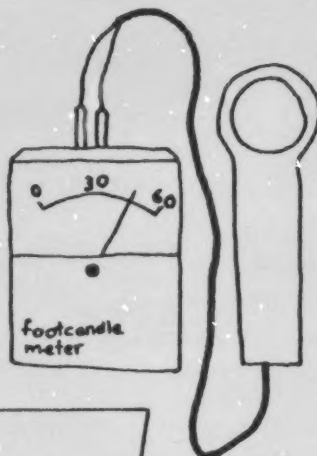
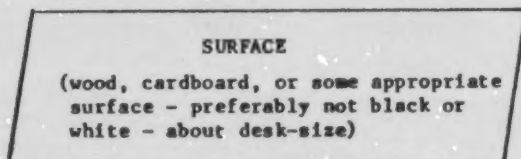
40W fluorescent light
and fixture

outlet



200W incandescent bulb
and fixture

space of
8'-9'



- Window shades should be closed.
- Fluorescent and incandescent fixtures are required to carry out this demonstration.
- The light source should be directly in front of (at as little angle as possible) the surface. The distance and angle between the light source and surface should be consistent for both types of lighting.
- Footcandle measurements can also be taken from overhead lights that are already in place.
- Call or write a science supply house to obtain a footcandle meter if you do not have one in your school or laboratory. Some good ones are Edmund Scientific, Markson, Nafco, Turtox-Cambosco, Ward's Natural Science Establishment.

1 Footcandle = 1 lumen per square foot

1 Lux = 1 lumen per square meter

1 Lux = 1 meter-candle

Number of luxes = footcandles x 0.76

Ask the students which type of bulb uses electricity more efficiently and thus conserves electricity better. (The incandescent bulb used 5 times as many watts as the fluorescent while projecting less light on a surface.)

Are we using the most energy-conserving bulbs in our room? If not, consider motivating the class to discuss replacement of incandescent by fluorescent bulbs with the school principal and custodian.

How could we calculate the savings in kilowatt hours that occur by using fluorescent bulbs? Students can compute the kilowatt hour savings produced by one fluorescent vs. one incandescent bulb over time by using the formula:

$$\text{Kilowatt hours} = \frac{\text{watts} \times \text{hours}}{1000}$$

Subtract the figure for the fluorescent bulb from the figure for the incandescent bulb to obtain the kilowatt hour savings. This can be done for a classroom by assuming that the usual classroom with incandescent light has five 200 W bulbs (1000 W). By replacing each 200 W incandescent bulb with a 40 W fluorescent, we are using 200 W of fluorescent lighting to provide the same amount of surface light. Using the kilowatt-hour formula, the savings can then be tabulated. In addition, fluorescent bulbs last 7 to 10 times longer than incandescent bulbs.

Now, ask your class to count the number of incandescent bulbs in the school hallways and offices and calculate the savings in kilowatt-hours if the bulbs were replaced by fluorescent bulbs. Savings in terms of oil, coal, and money can also be calculated. If possible in your particular school plant, motivate the class to consult the custodian and administration and start a project to change from incandescent to fluorescent lighting. Footcandle levels for different rooms and surfaces can be determined and lighting reduced within standards. Consult with your custodian.

Suggest that students conduct a similar project in the buildings in which they live and that they involve their parents, other tenants, and the landlord in the project.

Energy Action in Schools

K-12

PROJECT FOR AN ENERGY-ENRICHED CURRICULUM National Science Teachers Association Materials

sponsored by the U. S. Department of Energy

Classroom packets for grades K-12. Social Studies and Science emphasis.

Available:

-Limited copies from:

U. S. Dept. of Energy

Technical Information Center

P. O. Box 62

Oak Ridge, TN 37830 (615) 576-5454

- To teachers in PG&E service area:

Contact the area PG&E representative or write:

Mr. Richard J. McCamish

Pacific Gas and Electric Company

Supervisor Elementary and Secondary School

Services, Public Activities Department

215 Market Street, Room 655

San Francisco, CA 94106

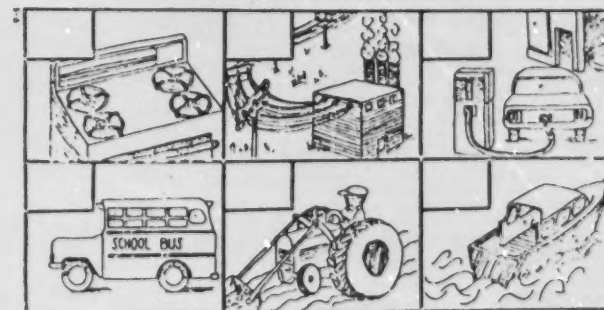
(415) 781-4211, Ext. 2379

These energy education packages written by Science and Social Studies teachers feature a wide range of activities that introduce basic energy concepts while encouraging direct student participation. Each packet contains student materials as well as background information for the teacher, lesson overviews, learning objectives, and teaching strategies.

Packet Title

The Energy We Use	1-2
Community Workers and the Energy They Use	2-3
Energy and Transportation	3-5
How we Make Energy Work	4-6
Networks: How Energy Links People, Goods, and Services	4-5
The Energy Game	4-6
Two Energy Gulfs	6-7
The Energy Future Today	7-9
Mathematics in Energy	7-9
Transportation and the City	8-9
Energy, Engine, and the Industrial Revolution	8-9
Energy Transitions in United States History	8-9
Energy in the Global Marketplace	9-11
How a Bill Becomes a Law to Conserve Energy	9-12
Agriculture, Energy, and Society	10-12
U. S. Energy Policy--Which Direction?	11-12

WHAT DO WE USE?



KEY

C

COAL

G

OIL or GASOLINE

G

NATURAL GAS

E

ELECTRICITY

From: THE ENERGY WE USE

Energy Action in Schools

Engine Puzzle



Across

1. The kind of engine in which fuel is burned outside the engine.
2. This engine is turned by the force of a gas or liquid acting against its vanes (blades).
3. The engine that gets thrust from high speed exhaust gases.
4. A jet in which some air by-passes the combustion chamber.
5. An internal combustion engine which requires no spark plug.
6. The only engine that will operate in a vacuum.
7. A small gasoline engine that does not use pistons.

Down

8. An engine with an air compressor used in most high speed aircraft.
9. A four-cycle internal combustion engine requiring spark plugs.
10. Non-reciprocating external combustion engine.
11. The kind of machine in which fuel is burned inside the engine.
12. A machine that changes another form of energy into mechanical energy.

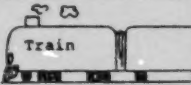
Word Study List

1. Steam engine - reciprocating external combustion engine.
2. Steam turbine - non-reciprocating external combustion engine.
3. Gasoline engine - a four-cycle internal combustion engine requiring spark plugs.
4. Ramjet - a jet with no moving parts.
5. Turbojet - an engine with a turbine driven air compressor used in most high-speed aircraft.
6. Fanjet - a jet engine in which some air by-passes the combustion chamber.
7. Rocket engine - only engine that will operate in the vacuum of space.
8. Diesel engine - internal combustion engine which requires no spark plugs.
9. Turbine - an engine turned by the force of a gas or liquid acting against its vanes or blades.
10. Jet engine - engine that gets thrust from high speed exhaust gases.
11. Engine - a machine that changes another form of energy into mechanical energy.
12. Reciprocating engine - engine which converts heat energy to mechanical energy by the back and forth motion of a piston in a cylinder.
13. Wankel rotary engine - a small gasoline engine that does not use pistons.
14. External combustion engine - the kind of engine in which the fuel is burned outside the engine.
15. Internal combustion engine - the kind of engine in which the fuel is burned inside the engine.

From: ENERGY, ENGINE, AND THE INDUSTRIAL REVOLUTION

Energy Action in Schools

Costs of Getting to Work

Types of Transportation			
Costs	One Way Gasoline \$.70 Parking 2.00 Other Costs .60 Total \$	One Way Fare \$.60 Total \$	One Way Fare \$1.30 Total \$
Time	25 minutes	35 minutes	20 minutes

Work the problems below:

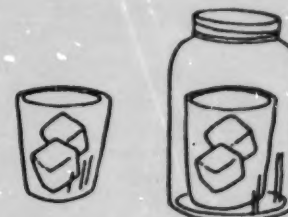
- How much does Mr. Hernandez have to pay each day to go to work and return by car?
- How much would it cost if he went by bus?
- How much would it cost if he went by train?
- How much time does it take?
 - By car? _____ minutes
 - By bus? _____ minutes
 - By train? _____ minutes
- Which transportation method do you think Mr. Hernandez should use? Why?

From: ENERGY AND TRANSPORTATION

HOW CAN ENERGY BE SAVED AT HOME?

16

Can this experiment give you a clue about how home heating and cooling bills can be cut? You will need to put an equal amount of ice into two small juice glasses. Place one juice glass into a larger jar and cover the jar with a lid. Note the time required to melt the ice in both glasses. Record this information on the chart.



	START	30 MIN.	15 MIN.	END MIN.
				
				

Which ice lasted longer?

Why?

Which parts in a house act like the jar to keep the heat in or out?

If you said storm windows and doors, you were correct. But tell why

From: HOW WE MAKE ENERGY WORK

Energy Action in Schools

K-8, 9-12

ENERGY, FOOD, & YOU, 1979

Teacher's Guide and Student Materials
Grades K-8, 9-12

Available from:

Energy, Food, & You Program
Washington State Office of Environmental Education, NW
2000 N. E. Perkins Way
Seattle, WA 98155
Attention: Christina Peterson
(206) 365-0433

Cost: \$5.00 each

With either of these thick activity guides in hand you are guaranteed to stimulate the creative mind of any student. The basic goal of each activity is to inform kids of the vital relationships between our environment, energy use, food consumption and nutritional health. Lesson titles like "How Far Did Your Breakfast Travel? Far Out Foods!" plus skits, puzzles, gardening and construction projects, graphs...clearly lay out our need to develop more efficient food systems. Both guides are divided into sections dealing with Global Food and Resource Issues, Energy and the U. S. Food System and Energy Efficient Nutrition. An additional indepth section on Basic Characteristics of Energy is provided in the secondary guide. Teachers who have tried various activities contribute their suggestions and both lesson plans and student materials are easily detachable.

HOW FRESH WATER IS USED BY AMERICANS

DIRECT PERSONAL USE:

8% of Total = 160 gallons per day

30-40 gal	= bath
5 gal/per min.	= shower
3 gal	= shaving (water on)
20-30 gal	= wash clothes
10 gal	= wash dishes
8 gal	= cooking
3-5 gal	= flush toilet
35 gal	= leak in toilet
80 gal	= sprinkle 8,000 sq. ft. of lawn
8 gal	= scrub and clean house
700,000 gal	= faucet and toilet leaks in New York City



INDIRECT AGRICULTURAL USE:

33% of Total = 600 gallons per day



40 gal	= one egg
80 gal	= one ear of corn
15 gal	= one slice of bread
46 gal	= 1/5th gallon of whiskey
75 gal	= 1 lb. of flour
2,500 gal	= 1 lb. of beef
18 gal	= 1/4 lb. of flour
625 gal	= 1/4 lb. of beef

INDIRECT INDUSTRIAL USE:

59% of Total = 1,040 gallons per day

720 gal/per person/per day	= cooling water for electrical power plants
320 gal/per person/per day	= industrial production of things
280 gal	= Sunday paper
300 gal	= 1 lb. synthetic rubber
1,000 gal	= 1 lb. aluminum
35 gal	= 1 lb. steel
7-25 gal	= 1 gallon gasoline
100,000 gal	= 1 car



Compare the average amount of water used by an American with the amount used by a person of a developing country:

1,800 gal/per day	= per person, United States
12 gal/per day	= per person, developing country

Now make a list of ways you can conserve usable fresh water. List both direct and indirect ways.

Source: G. Tyler Miller, Jr., Living in the Environment: Concepts, Problems and Alternatives.

EnergyAction in Schools

K-8, 9-12

ENERGY, FOOD, & YOU, 1979

Teacher's Guide and Student Materials

Grades K-8, 9-12

Available from:

Energy, Food, & You Program

Washington State Office of Environmental Education, NW

2000 N. E. Perkins Way

Seattle, WA 98155

Attention: Christina Peterson

(206) 365-0433

Cost: \$5.00 each

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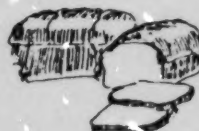
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Source: G. Tyler Miller, Jr., Living in the Environment: Concepts, Problems and Alternatives.

Energy Action in Schools

2-adult

ENERGETICS--Nature's Energy Game and
ENERGETICS Activity Book, 1979

Board game and energy activity work-
book; Grades 2-adult

Available from:

Soft Aware Association, Inc.

2431 Elendil Lane

Davis, CA 95616

(916) 753-5649

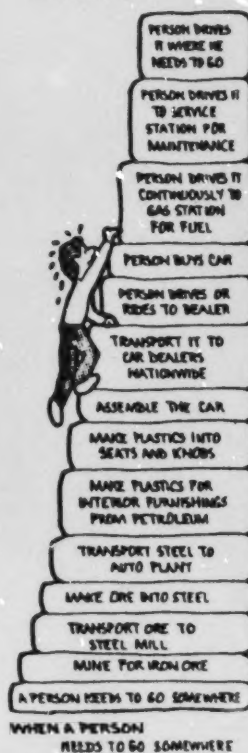
Cost: \$15.95/game and workbook

\$ 1.00/workbook alone

Playing ENERGETICS really does guide its players towards an understanding of the role of energy in natural systems. Groups of two or more students and teachers will enjoy the strategy of the game as well, since it is involving and entertaining. The game is a good motivational tool for an energy unit. The game materials and pieces are made to last. The workbook can be used by a teacher or upper elementary students. It includes energy activities and facts.



STEPS TAKE LOTS OF ENERGY



GROWTH

1



Speed Demands Energy

Electric gadgets do many jobs faster than we can do them by hand—but they use up a lot of energy. Going fast is an energy drain.

WASTE

1



Reuse Materials

Returnable bottles are reused an average of 14 times before they break. We can save the energy and material costs of making 13 new bottles by reusing one.

SHIFTER

1



Insulation for Warmth

Insulation keeps the heat inside of buildings during cold months. Foam, treated paper and fiberglass are some of the materials we use to fill spaces within the walls of our homes.

GROWTH

3



Limits to Growth

When we discovered the powerful energy stored in fossil fuels our civilization grew fast. Now, as these supplies get low, we can turn to other energy sources that won't run out for billions of years.

Sample Energy Cards

Energy Action in Schools

4-12

REEL CHANGE

Reference book, 54 pages

Grades 4-12

Available from:

Friends of the Earth

124 Spear Street

San Francisco, CA 94105

(415) 495-4770

Cost: \$3.50

A handbook of Appropriate Technology films that doesn't beat around the bush. Accompanying each film listing is a detailed paragraph outlining the film progression, highlights and low points, suggested audience and film distributors. Film ratings, prices and a subject index are also included by authors who seem to have a firm grasp on film antiquities.



Grassroots Energy

28 minutes

1978

UM

Farmers in west central Minnesota have been protesting the construction of power lines across their farmland. They have been joined in their resistance to the power coops by supporters in the twin cities. All this is very interesting, but what does it have to do with a.t.?

The farmers discover that they cannot just react against the power company and the state. To have any impact they must address the energy development policy. This naturally leads to an examination of alternative energy sources.

The film is one of the better ones available on alternative sources. It investigates the reasons why people have turned to human scale alternatives, and explores people's frustration with the bureaucracy of the power company and the state which supports it.

Scenes of farmers marching in subzero weather make it clear that they are willing to put up with great discomfort in order to preserve the quality of life in rural Minnesota. These scenes are followed by a very good explanation of the alternative energy sources the farmers themselves are investigating.

The major problem with this film is the script. It does not make clear from the start what the film is about. The transition from protest to a.t. is not made smoothly. And there is a long segment dealing with wireless electricity which is too far from the focus. But these problems are offset by the presentation of farmers of all ages fighting for the integrity of the land.

The film was made by an anthropologist with an objective perspective. It is a particularly good film for those interested in grassroots organizing.

EnergyAction in Schools

K-6

MANURE TO MEADOW TO MILKSHAKE
Teacher's Guide/Activity Materials
130 pages, Grades K-6

Available from:

Hidden Villa Environmental Project
26870 Moody Road
Los Altos Hills, CA 94022
(415) 948-4690

Cost. \$4.95 + \$1.25 postage

An activity-oriented guide book that outlines group energy projects for inside and outside learning. Ten to fifteen of the activities deal directly with energy education; others deal with the spectrum between environmental awareness and decision-making. Each activity is divided into four parts: preparation, insight, action, and follow-up. Eleven songs, poems and puppet shows are also included.

PUPPET SHOW: "INTERVIEW THE EARTH"

-Hello and how are you, World?



INSIGHT

People are relatively recent inhabitants of planet earth. We demand much of the earth's resources and too often are ignorant, selfish or thoughtless caretakers. Let's get a perspective on human life on planet earth.

PREPARATION

1. Make an earth puppet out of styrofoam, a ball or a reel globe that can be spun as the earth speaks.
2. Put time scale on blackboard or use a large chart* so all can read.
3. Choose narrator and earth puppeteers. Rehearse following script.

NARRATOR:

Hello earth! How are you today?

EARTH:

Oh, pretty good, half in the sunshine, half in darkness.

NARRATOR:

Say, earth, do you mind if I ask you a rather personal question? How old are you?

EARTH:

Well, er, if you really must know, I am five billion years old.

NARRATOR:

Five billion years old! How old is that?

EARTH:

Well, it's rather hard to explain five billion years. But are any of you boys and girls ten years old? Let's pretend five billion years is ten years, and then maybe you can begin to see my own time scale. I will read the Event, and you, Narrator, read the Time in Past and you boys and girls read the time as Reduced to Ten Years. All right?

EARTH:

Now, looking at that chart, who has been around longer, man or dinosaurs? Have you seen any dinosaurs around lately? That's right! They are extinct, and their remains have turned into fossil fuels, plastics and asphalt, among other things. What will happen when the dinosaur remains are all used up?

NARRATOR:

Well, we're talking about solar energy, making energy from garbage, but less that all costs a lot of money right now. Do you have any other problems you want to share, Earth?

EARTH:

Well, yes. I have lots of people living on me. All wanting clean air, water, shelter and food. It's tough being a fair landlord. Hey, you guys can you imagine how long your class line is when you line up to come into your room? Well, if all the world's people were to line up, one behind the other, the line would go fifty times around the fattest part of me. You know, my wasteline called the equator. Or to put it another way, all the world's people lined up one behind the other would stretch from the earth to the moon and back again two and one half times. Can you kids think of any problems I might have from all of those people living on me? Raise your hand if you know of any.

(Hints: air pollution, not enough water, dirty water, litter, noise pollution, not enough room for wild animals, not enough food or energy to go around, and so forth)

NARRATOR:

OK! Those are some of my problems. Let's assume there are 30 kids in this classroom. Let's divide you into three groups. One third of you represent countries like the United States, Japan, Canada and Western Europe. You have plenty to eat. Stand up and pat your full stomachs. The next group stays seated. Your diet is like it is in China today. Adequate, but not over abundant. The last group doesn't have much strength and you can put your heads down on your desks. You people are located on many continents, Asia, Africa and the Americas. A typical dinner for a child in this group would be one third of a cup of rice and a half a cup of tea. You go to bed every night feeling hungry. Think about what you had for dinner last night? Wow. You are lucky!

NARRATOR:

Thanks World. Maybe we can figure out some ways to help you keep you clean and beautiful. See you later!

FOLLOW-UP

1. Build a time line around the top of the walls in your classroom.
2. Serve a Third World lunch one day. (see World Food Day Story, page 116).
3. Read and discuss Angel Island Story, page 115).

EVOLUTIONARY TIME SCALE courtesy Dr. Sidney Liebes

Event	Time In Past	Time Reduced To Scale of Earth Origin 10 Years Ago
Origin of Earth	5 billion years ago	10 years ago
Primitive Life Forms	4 billion years ago	8 years ago
Age of Dinosaurs	Two hundred 65 million years ago	5 months 6 weeks ago
First People	2 million years ago	1 day ago
Last Ice Age	10 thousand years ago	10 minutes ago
Columbus Discovered America	500 years ago	30 seconds ago
Human Life Span	70 years	4 seconds

Energy Action in Schools

1-3, 4-6

THE BEST BOOK OF ENERGY (2 books)
 Grades 1-3 & 4-6)
 Teacher's Guide & Student Materials
 1-3, 135 pp.
 4-6, 160 pp.
 Available from:
 Modern Curriculum Press
 13900 Prospect Road
 Cleveland, Ohio 44136
 Attention: Renate Beal
 (216) 238-2222
 Cost: Book 1 (Grades 1-3) \$8.55
 Book 2 (Grades 4-6) \$8.55
 Per set, \$15.00

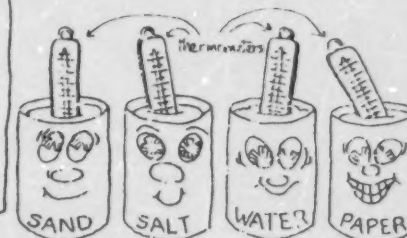
The main objective of the Best of Energy Books is to make students, teachers and parents aware of limited energy sources and the need to adopt a more energy conserving lifestyle. Energy topics are taught in conjunction with fundamental subjects such as reading, math and social studies, giving students a fun, productive way to reinforce their basic skills. The books are organized according to subject matter with four major messages: sun power, energy loss and gain, renewing our resources and individual energy responsibility. Background lesson information is provided for teachers.

WHICH MATERIAL STORES SOLAR ENERGY THE BEST?



MATERIALS:

Cardboard box
 Black paint
 4 Small metal cans
 4 Thermometers
 Sand, salt, water, and
 torn-up paper



Fill the cans and place a thermometer in each one.

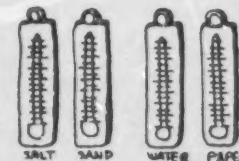


Paint the box black, and put the cans in the box.

Place the closed box in the sun for 1/2 hour!



Now remove the cans and watch the temperatures fall. Stir occasionally. Which temperature falls the slowest?



Which stores solar heat best?

Energy Action in Schools

2-3; 5-6

AUNT ENERGINA'S ALMANAC and
THE ADVENTURES OF AUNT ENERGINA
Teacher's Guide and Student "comic
book format" workbook

Grades 2-3; 5-6

Available from:

Contact your local utility

Cost: Free from many utilities

The student "comic" workbook is an appealing format for this energy conservation material. The materials have been rated by teachers as being "excellent" because they can be used without teacher preparation, while there are many helpful resources available in the teacher's guide. The teacher's guide provides teachers with basic energy information, curriculum extension ideas, thermofaxable student activity sheets and sources of further information. The activities can easily be incorporated into an existing curriculum. The student workbooks are full of stories, puzzles and energy conservation information; also available in Spanish.

AGENT 00638

HOME ENERGY INVESTIGATION

Here's a chance to join the Energy Agents and help them conserve energy in your own home. Your job is to investigate your family's appliances in search of clues for saving energy.

First, decide how each one is used in your home. Check the column marked "HEALTH/CLEANLINESS" if the appliance keeps you healthy, clean or safe. If it makes you more comfortable or makes a job easier, check "COMFORT/CONVENIENCE." If you use the appliance just for fun, check the "ENTERTAINMENT" column.

Next, go through your home and see how many of the items on the list you can find. In the column headed "NUMBER IN

HOME," write down how many of each appliance your family has.

Now, decide how important these appliances are to your family. If you really "CAN'T LIVE WITHOUT IT," circle number 1. But if you think "WHO NEEDS IT?" then circle number 5. If it is somewhere in between, circle 2, 3 or 4, depending on how important you think it is.

Finally, mark in the "ENERGY CONSERVATION" column the ones that you think you can use less or more efficiently to save energy.



ELECTRIC OR GAS APPLIANCE	USE		IMPORTANCE		ELECTRIC OR GAS APPLIANCE	USE		IMPORTANCE	
	HEALTH/CLEANLINESS	COMFORT/CONVENIENCE	ENTERTAINMENT	CAN'T LIVE WITHOUT IT		HEALTH/CLEANLINESS	COMFORT/CONVENIENCE	ENTERTAINMENT	CAN'T LIVE WITHOUT IT
AIR CONDITIONER				1 2 3 4 5	KNIFE SHARPENER				1 2 3 4 5
BLANKET				1 2 3 4 5	MICROWAVE OVEN				1 2 3 4 5
BLINDER				1 2 3 4 5	NOISE PROJECTOR				1 2 3 4 5
CAR OPENER				1 2 3 4 5	PENCIL SHARPENER				1 2 3 4 5
CARRYING KNIFE				1 2 3 4 5	RADIO				1 2 3 4 5
CLOCK				1 2 3 4 5	RANGE				1 2 3 4 5
CLOTHES DRYER				1 2 3 4 5	REFRIGERATOR/FREEZER				1 2 3 4 5
CLOTHES WASHER				1 2 3 4 5	SANDWICH GRILL				1 2 3 4 5
COFFEE POT				1 2 3 4 5	SEWING MACHINE				1 2 3 4 5
CORN POPPER				1 2 3 4 5	SHAPER				1 2 3 4 5
DEHUMIDIFIER				1 2 3 4 5	STENO				1 2 3 4 5
DISHWASHER				1 2 3 4 5	SWIMMING POOL FILTER PUMP				1 2 3 4 5
DRILL				1 2 3 4 5	SWIMMING POOL HEATER				1 2 3 4 5
FAN				1 2 3 4 5	TELEVISION				1 2 3 4 5
FLOOR POLISHER				1 2 3 4 5	TOASTER				1 2 3 4 5
FOOD FREEZER				1 2 3 4 5	TOOTHBRUSH				1 2 3 4 5
FOOD MIXER				1 2 3 4 5	TVS				1 2 3 4 5
FOOD PROCESSOR				1 2 3 4 5	TRASH COMPACTOR				1 2 3 4 5
FRYING PAN				1 2 3 4 5	TYPEWRITER				1 2 3 4 5
GARAGE DOOR OPENER				1 2 3 4 5	VACUUM CLEANER				1 2 3 4 5
GARBAGE DISPOSER				1 2 3 4 5	Waffle IRON				1 2 3 4 5
HAIR CURLERS				1 2 3 4 5	WATER HEATER				1 2 3 4 5
HAIR DRYER				1 2 3 4 5	OTHER:				1 2 3 4 5
HOT WATER HEATING				1 2 3 4 5	1)				1 2 3 4 5
ICE CREAM FREEZER				1 2 3 4 5	2)				1 2 3 4 5
IRON				1 2 3 4 5	AGENCY NAME				
JUICE EXTRACTOR				1 2 3 4 5	DATE OF INVESTIGATION				

EnergyAction in Schools

4-6

YOUR ENERGY WORLD, Units 1-4
Teacher information folder and 4-5
student dittos masters per unit,
Grades 4-6

Available from:

Supt. of Documents
U. S. Gov't. Printing Office
Washington, D. C. 20402

Cost: \$8.00/four units, payable to
Supt. of Documents

(202) 783-3238

This set of interdisciplinary curriculum packets emphasizes energy savings through conservation. The first unit provides an "overview" of energy definitions, energy resources, and possible energy problems. The other three units can be used interchangeably; they cover conservation in the transportation, residential-commercial, and schools community sectors. An interesting variety of student activities are provided, with good teacher background information. This is easy to use, and a good resource to have.

ACTIVITY MASTER 1: WHAT'S WRONG HERE?

Students will analyze typical uses and misuses of energy in a school environment. They will investigate and measure their own school's monthly energy consumption and will become more aware of day-to-day conservation measures they can put into practice in their school.

Activity Method

On the day before you begin this activity you will have to set the stage for the simulation. Many of your students might not be familiar with the workings of a school board. You can give them the background they need by leading them in a discussion about the function of the school board in your community. Begin by asking: Does anyone know what a school

board is? Do you know anyone who is on the school board? How does one become a member of the board? This discussion will give you an opportunity to tell them that the school board is the elected policy-making body in your school system, made up of citizens of the community.

On the day of the activity, rearrange the classroom to make it look like a meeting room. Once the students are assembled, you can either allow the students to volunteer for specific roles or you can assign them. On the non-reproducible side of Activity Master 1 you will find suggestions of roles to be played.

Once the stage has been set, the cast of characters has been appointed, and the children have taken their places, tell them that the school board, with help from the community, must act on two recent events: first, they have been notified that the energy allotment for the coming school year has been cut by 25 percent or one-fourth of last year's amount, and second, the community has voted sufficient funds to build a new energy-efficient school in its district within five years.

To give the children a place to start their investigation of school energy problems, explain to them that before the members of a basketball or football team, for instance, can perfect a particular play, they have to be able to examine their own mistakes. To help them do this, coaches often provide their teams with visual aids in the form of video tapes of games already played, or they illustrate errors by use of diagrams. So too, can people be told they are wasting valuable energy, but they might not believe it until they actually step back and watch themselves.

Students will study the three pictures on Activity Master 1 and list all the ways they can find that energy is being wasted. The answers, written in red on the master, will not reproduce on the students' copies.

After the students have discovered the obvious misuses of energy pictured on the master, they might be asked to suggest ways to improve the situations. The student who is acting as

secretary or recorder of the school board meeting can write down all the suggestions, to be used later in planning the "ultimate" in energy efficient schools.

Additional Activities

1. The president of the school board can appoint several committees whose task is to investigate the students' actual classroom and school. The committees might tour the school, taking notes of any of the misuses of energy they observe during the investigation. They can then report their findings to their classroom "school board" at its next meeting. (Be sure to clear "trips" around the school with administrators, kitchen supervisors, and maintenance people.)

Organize four committees, with the following objectives:

Classroom-Hallways

- Find out what kinds of energy are used on the school site and for what purposes.
- Find out what the methods are for measuring energy usage.
- List the school's energy decision makers.
- Survey the kinds of energy being used in this classroom (heat, light, electrical, food, etc.).
- Figure out ways to measure how much energy is being used (thermometers and light meters).
- Check for lights burning near sunny windows, unnecessary lights burning in hallways and classrooms, other energy misuses.

Boiler Room

- Ask custodian to show students the electric and gas meters.
- Find out what kind of furnaces are used and how much energy they use each month.
- Find out how water is heated.
- Trace the ductwork to the classrooms.

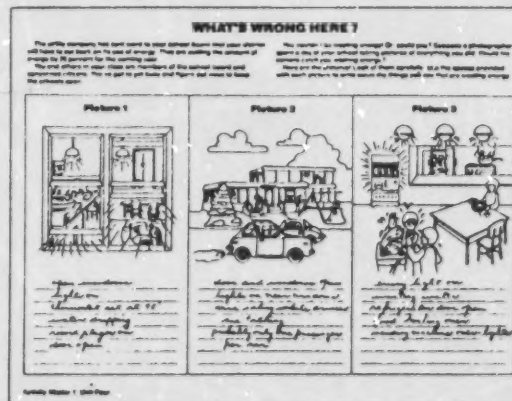
Kitchen

- What is energy used for in the kitchen and what kind is used?
- Students might want to discuss "energy saving" equipment as opposed to "labor saving" equipment. How many people work in the kitchen?
- What are some ways to conserve energy in the kitchen?

School Garage

- Find out how many buses the school system operates and how many miles a day each bus travels.
- How many miles per gallon of gasoline do the buses get?
- See if buses are kept in a heated garage.
- Find out how old the buses are and if they are on a regular maintenance schedule.
- Are bus routes set up to get the most of each energy dollar?

2. As a project in math class, the students could be shown figures of their school's actual monthly energy consumption. The simulated school board might again appoint a committee to study the cost of utilities and to make a record of monthly consumption. It will discover that during some months consumption is higher than it is in other months. The class can discuss correlations between energy use and outside temperature, for instance, or energy use and vacations or extracurricular activities.



EnergyAction in Schools

4-6

GET YOUR HANDS ON ENERGY
(A Teaching Guide about Renewable
Energy) Grades 4-6
Teacher's Guide, 100 pages
Available from:

New Western Energy Show
220 Power Block
Helena, MT 59601
(406) 443-7272

Cost: \$5.25, postpaid

This informal teaching guide suggests a sensory-appreciation approach to renewable energy and conservation for the 4-6 classroom. Teachers have a wide variety of flexible activities to pick and choose from. The guide consists of nine chapters covering energy awareness, solar, water, wind, energy conversions, energy flow, conservation and waste recycling and packaging. The guide was prepared by the New Western Energy Show, a performing group which does dramatic musical presentations throughout the North West, and the Alternative Energy Resources Organization which operates a resource library in Helena, Montana.



AND THAT'S A LOT OF WASTED HOT WATER!!

HEATING YOUR WATER

[DID YOU KNOW THAT THE WATER HEATER IS THE SECOND GREATEST ENERGY USER IN YOUR HOUSE, NEXT TO SPACE HEATING? AMAZING, ISN'T IT?]

Find your hot water heater. Is it run by gas or electricity or something else? Now find the thermostat. What is the temperature? You can reset it to 120° or on "low" and this will still be enough to get dishes really clean.

Is your hot water tank insulated?
Help your parents put a jacket of insulation around it.

Check the hot water pipes. Are they in unheated places under the house? Are they insulated?
Help your family wrap insulation around them to keep the water hot until it reaches your sink.

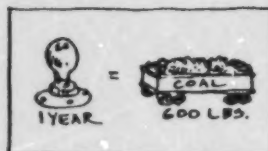
When you wash dishes, do you run hot water to rinse them?
Use a tub of rinse water to stop hot water waste.

NEXT TIME YOU TAKE A BATH, MARK THE WATER LEVEL ON THE TUB WITH A GREASE PENCIL.



DOES MORE? A SHOWER OR A BATH?

Which do you take more often? A bath or shower?
Take showers as often as you can instead of baths. From now on, use less water when you take a bath or shower.



DO YOU WASTE ENERGY WITH LIGHTS AND APPLIANCES?

Do you always turn off the lights when no one is using them?
Go around your house and turn off all unused lights.

Are there any lights you think are too bright for their use?
Help your family change light bulbs to lower wattage ones.

Energy Action in Schools

5-6

CONNECTIONS

Teacher's Manual & Student Materials
Grades 5-6

Available from:

National Center for Appropriate
Technology (NCAT)

Box 3838

Butte, MT 59701

Cost: \$5.00

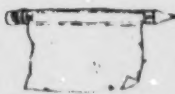
(406) 494-4572

This workbook is an imaginative and far-reaching teacher/student resource. Ten lessons take a grassroots look at various aspects of technology, emphasizing ways to recycle on the home front first. A host of innovative projects, such as building a solar fruit dryer, allow students to actively experience energy self-sufficiency. Combined with discussions, handouts and quizzes, the class and home activities provide a thorough investigation of alternative energy applications. Teachers are furnished with substantial background information and captivating graphics to keep the kids well-entertained.



THE HEAT LEAK DETECTIVE GAME

TOOLS



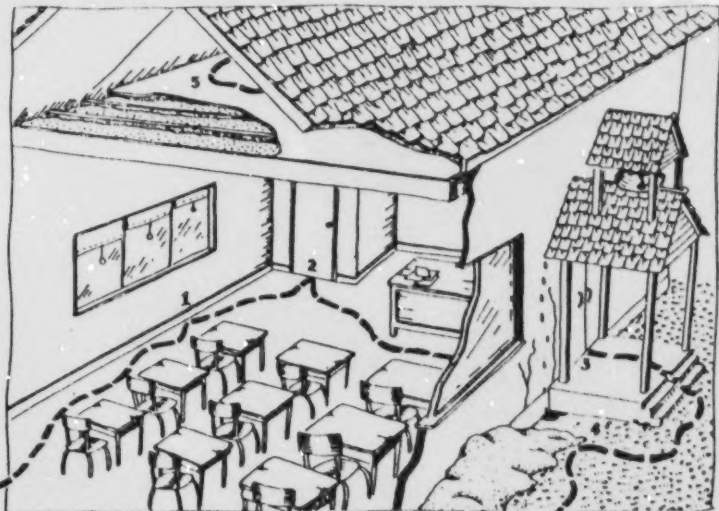
- 1) a draft detector made by taping plastic lead wrap to a pencil.
- 2) a note pad and pencil to jot down clues and findings.

FIND THE HEAT LEAKS IN YOUR SCHOOL

- 1) Search out drafts by holding the draft detector to probable leaks. Does the plastic move?
- 2) Write down the trouble spots and describe the ways of plugging the leaks.
- 3) Return to class with your findings. Who in the class found the most leaks?

1. **Curtains or Shades:** Are curtains used at night to hold the warm air in? Could carpets or rugs contribute to keeping the air in?

2. **Storage Rooms and Closets:** Are the doors of storage rooms and closets left open? Areas not commonly used need not be heated and should be kept shut off from other rooms. Do their doors fit tightly, or is heat leaking out from them?



3. **Windows and Doors:** Are doors or windows left open for no reason? Is there weather stripping around doors, caulking around windows? Do the window frames fit tightly against the wall of the room, or is there heat escaping through cracks? Does the glass fit tight in the frame? Are storm windows used in the winter? Are double door entrances used, with each door kept shut when not in use?

4. **Outside the School:** Are there cracks in the brickwork or related leakage or shrapnel in other construction materials? Earth piled against the wall can allow damp to penetrate the walls, requiring unnecessary heating. Is there water dripping or splashing against the wall? Do the windows and doors fit tightly from the outside?

5. **The Roof or Attic:** Is there insulation? Is the structure solid and leaky, lined? Are there gaps or cracks in the material? Is there a structural air gap?

Energy Action in Schools

4-6

ENERGY MANAGEMENT CENTER INTERMEDIATE PROGRAM

Teacher Training Manual & Student

Materials, Grades 4-6

Available from:

Pasco County Schools

Energy Management Center

P. O. Box 190

Port Richey, FL 33568

(813) 848-4870

Cost: Modules A, B, C - each is \$.90

x # students

Lab Supply List - each is \$.10

x # students

(Solar Cooker Kit Directions-\$.10

x # students - optional)

Teacher Manual - \$8.25

Teacher Training Evaluation

Instruments - each is \$.10

x # teachers

Part of a wholistic curriculum program, this modular energy package is divided into three themes: "Let's Learn about Energy", "Nature's Energy" and "Man and Energy". Each three-week module explores one of these topics through several disciplines including language arts, math, social studies and art. Value clarification is taught via hands-on energy conservation activities within a lab-type structure. A helpful method book furnishes teachers with background information, a suggested calendar, and additional activities for enterprising students.

L.A.P. TWO SPELLING BEE

Here is a list of energy words to study for a class spelling bee. To help you learn them, unscramble those given on the right from the list on the left:

atomic	1. dowo _____
coal	2. sga _____
electrical	3. alsro _____
energy	4. uns _____
fire	5. kowr _____
gas	6. etha _____
gravity	7. aclo _____
heat	8. lio _____
kinetic	9. erif _____
light	10. glith _____
mechanical	11. woerp _____
moving	12. tenlopati _____
oil	13. artedo _____
potential	14. motcai _____
power	15. ticniek _____
solar	16. calilecter _____
stored	17. nachmiclea _____
sun	18. vtagiry _____
wood	19. vignmo _____
work	20. gyneer _____

Energy Action in Schools

4-6

AN ENERGY CURRICULUM FOR MIDDLE GRADES: UNITS I AND II
Teacher's Guide & Student Materials for Grades 4-6; Unit I, 229 pp., Unit II, 174 pp.

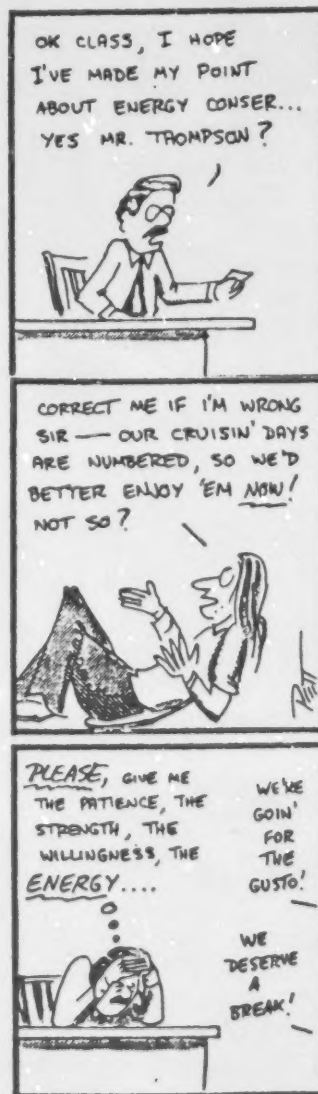
Available from:

ERIC Documents & Reproduction
P.O. Box 190
Arlington, Virginia 22210
(703) 841-1212

Cost: Unit I ED 187-554, \$16.85,
Unit II ED 187-555, \$11.90,
or microfiche, .91

.91
1.82 + 35¢ post.

These two middle school units investigate different but related aspects of energy: "Energy in World Cultures" and "Energy in American History." Accompanied by an introductory cartoon book, each unit contains imaginative lessons and activities concerning energy concepts, processes and policies. Unit I establishes energy basics while Unit II involves more advanced ideas and skills; both units can be used independently. Mini lessons encompassing several subjects can be taught by a collective group of teachers from different disciplines. Both student materials and teacher's guide are designed to recognize adolescent potential through positive energy roles.



Class-Based Activities

An Energy Audit. Your class could conduct an energy audit of your classroom or the school by making a list of those things which use energy in the school and then seeing how much energy is used by the items on your list. They might conduct this audit daily or weekly for some time and then determine ways in which they might save on energy use in the school.

Energy Aides. Your class might volunteer to help with conservation by patrolling doors and specific rooms to make sure windows and doors are closed. They might prepare a form where they can write down what success or lack of success their efforts have. If the patrol is successful, students might work with students in other classes in setting up a permanent group that would help the school save energy.

Lights Out! Students in your class might initiate a campaign to use half the electricity they currently consume in their school. They might determine ways in which the classrooms, libraries, cafeterias and other areas of the school could use less lighting and still function effectively. They should be sure that the lighting changes they make are actually more energy efficient by studying the electrical use of

An Energy Exhibit. Students might set up an exhibit in the cafeteria which shows knowledge about energy and ways in which students might conserve. They could set up, for example, various ways of cooking hot dogs in the cafeteria, or some other moving exhibits, so that students could actually try it out themselves.

Take It Home. The class could initiate an energy survey of tips on energy conservation. They could ask people in their school and community to share ideas with them about conservation. They could then make a booklet of these ideas. They could share the booklet with their parents and come up with class results in energy conservation that were chosen by families within the class.

Person Power! Students in the class could devise a series of posters to be used around the school on how students could use their own energy rather than mechanical forms of energy in trying to conserve electrical power and other sources. In this way, other students in the school would be exposed to knowledge about their own personal energy. Students who use their own personal power instead of other appliances or machines might be given an award by the students in the class.

Energy Action in Schools

6

ENERGY LEARNING CENTER

Teacher's Guide and Student Materials

Grade 6

Available From:

Youth and Education

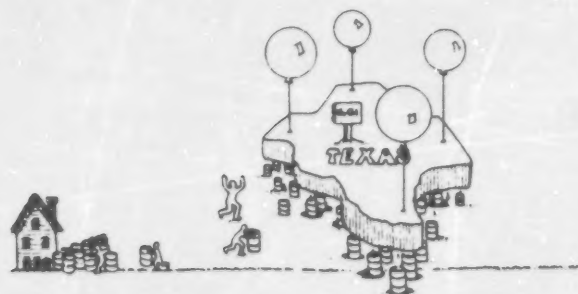
Chevron USA

P.O. Box 7753

San Francisco, CA 94120

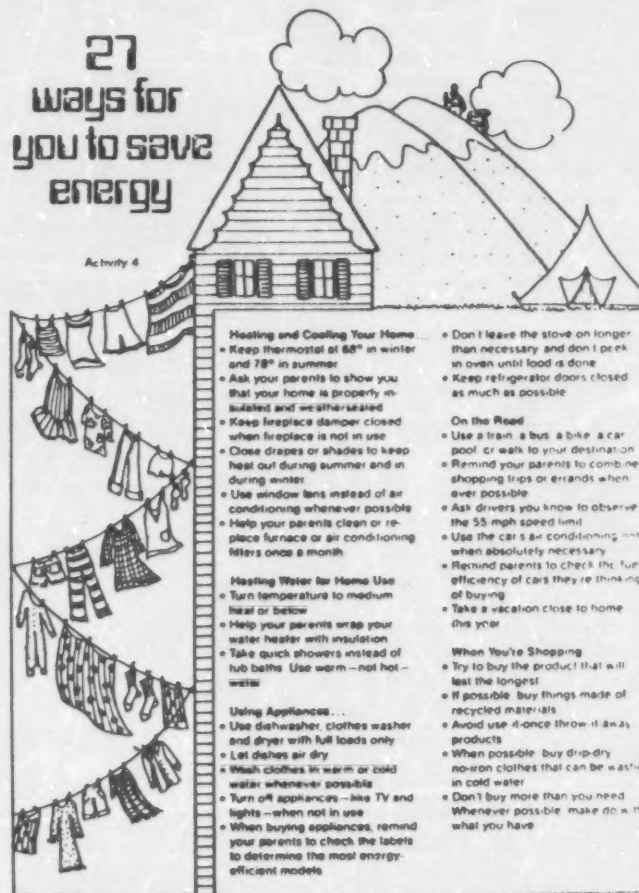
Cost: 1 free per school

Chevron takes a versatile approach to energy instruction in this packet. Three units describe a range of both conventional and alternative energy resources through exploring their history, technology and present day usage. Graphic ditto masters and student fact sheets are accompanied by a time graph of energy development over the past 500 years. A teacher's guide is included and even the cover is useful as a fold-out poster of an energy efficient town.



27 ways for you to save energy

Activity 4



Heating and Cooling Your Home

- Keep thermostat at 68° in winter and 78° in summer.
- Ask your parents to show you that your home is properly insulated and weather-sealed.
- Keep fireplace damper closed when fireplace is not in use.
- Close drapes or shades to keep heat out during summer and in during winter.
- Use window fans instead of air conditioning whenever possible.
- Help your parents clean or replace furnace or air conditioning filters once a month.

Heating Water for Home Use

- Turn temperature to medium heat or below.
- Help your parents wrap your water heater with insulation.
- Take quick showers instead of tub baths. Use warm—not hot—water.

Using Appliances

- Use dishwasher, clothes washer and dryer with full loads only.
- Let dishes air dry.
- Wash clothes in warm or cold water whenever possible.
- Turn off appliances—like TV and lights—when not in use.
- When buying appliances, remind your parents to check the labels to determine the most energy-efficient models.

- Don't leave the stove on longer than necessary and don't peek in oven until food is done.
- Keep refrigerator doors closed as much as possible.

On the Road

- Use a train, a bus, a bike, a car pool, or walk to your destination.
- Remind your parents to combine shopping trips or errands whenever possible.
- Ask drivers you know to observe the 55 mph speed limit.
- Use the car's air conditioning only when absolutely necessary.
- Remind parents to check the fuel efficiency of cars they're thinking of buying.
- Take a vacation close to home this year.

When You're Shopping

- Try to buy the product that will last the longest.
- If possible, buy things made of recycled materials.
- Avoid use-it-once-throw-it-away products.
- When possible, buy drip-dry, no-iron clothes that can be washed in cold water.
- Don't buy more than you need. Whenever possible, make do with what you have.

EnergyAction in Schools

8

ENERGY IN AMERICAN HISTORY
Teacher's Guide and Student Workbook
and Filmstrip

Grade 8 Social Studies

Available from:

Several utility companies

Cost: Free from many utility
companies

For further information, contact
Energex Energy Education
Programs at (213) 420-6814

This filmstrip-workbook combination gives the student both a visual and written understanding of how our present energy situation has evolved. The workbook is clearly-written and comprehensive. Students are asked to answer review questions and do written exercises. A glossary is included.



Case Studies For Debate Preparation

Directions:

In class, you will have the opportunity to participate in a debate. The debate will explore the advantages and disadvantages of two important energy-related developments: the automobile and nuclear energy. After you have been assigned one of these debate topics, read carefully the case study that relates to your topic. The case study will give you some background information you will need to prepare your debate argument.

Case Study = 1 —The Automobile

You have already learned how Henry Ford's Model T was born. Although Ford pioneered the mass manufacture of automobiles, others soon followed his lead. In 1910, two years after Ford began production, there were 458,377 passenger cars registered in the United States. By 1965, there were more than 68 million registered. Let's follow up on the story of the automobile and see what impact it has had on the United States.

Road Building

The first federal highway construction program began in 1916. Through the following decades, the number and miles of highways increased at a steady rate. During World War II, Congress adopted the Interstate and Defense Highway Act of 1944. It was partly to provide necessary military communications, but it was also designed to develop a national highway system for peacetime needs.

Though 1.5 million dollars was originally set aside for the project, this amount proved inadequate. By 1965, the price tag had risen to more than 46 billion dollars—and the Interstate highway system wasn't even complete! As each mile of the system



Energy Action in Schools

7-12 (also 5-6)

IOWA DEVELOPED ENERGY ACTIVITY SAMPLER
(I.D.E.A.S.)

Student Activities Notebook and Teacher Reference Guide

Grades 7-12 (but it is an excellent reference for 5-6 as well)

Available from:

Joan Overton

Instruction & Curriculum

DPI

Grimes Building

Des Moines, Iowa 50319

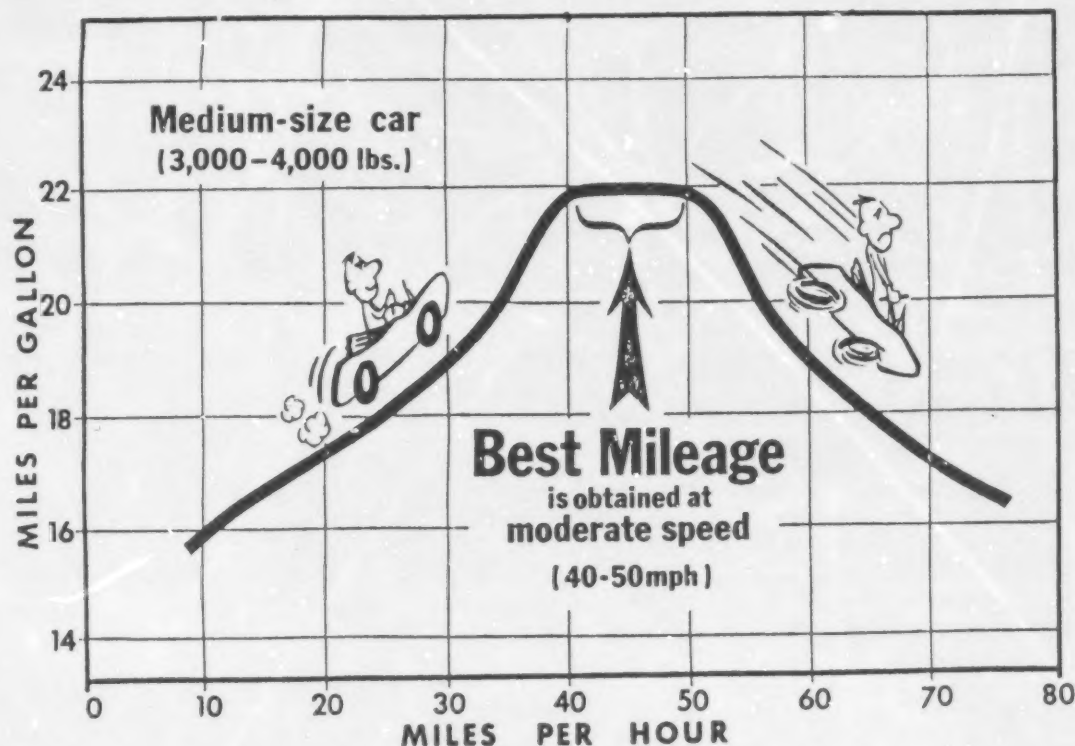
(515) 281-5839

Cost: \$9.00 for Science Plus make checks payable to:

Iowa Energy Policy Council

The IDEAS notebook is a marvelous collection of 98 student energy activities, teacher resources and energy information. The materials are multidisciplinary, so they can be used by teachers in all disciplines. Clear graphics and charts make the notebook easy to use.

The lessons are activity oriented, and inspiring to a teacher who is planning their curriculum.



Data from American Automobile Association.

Transportation: Carpooling Saves

Objective:

To develop awareness of the costs of operating a car and of the cash savings possible by carpooling.

Energy Action in Schools

Car Type	Costs per mile					
	Depreciation (cents)	Parts & Tires (cents)	Gas & Oil (cents)	Insurance (cents)	Taxes (cents)	Total Cost (cents)
Standard	17	5	7.5	2.1	1.7	28.3
Mid-Size	11	5	5.5	2.0	1.6	25.1
Compact	9	4	4.5	2.0	1.3	20.3
Sub compact	7	4	4.0	2.0	1.0	18.0

Example:

To figure commuting cost, multiply number of miles (say 20) times cost for a mid-size car (Chevy Malibu)--

- $20 \times \$2.51 = \$5.02$
- Add daily parking fee + \$.50
- Total daily cost \$5.52
- Multiply daily cost x number of school days per month (21) for total cost per month to drive alone (\$115.92).
- Divide this by the number of people in the carpool (say 4)--
 $\$115.92 \div 4 = \$28.98$, cost per passenger in car pool
- Monthly savings, per person, is the difference in cost between driving individually and using the carpool.
 $\$115.92 - \$28.98 = \$86.94$

Note that more than money is saved. Energy use is reduced, and environmental damage is also less. Parking areas do not have to be so large and the atmosphere does not have to absorb so much heat and exhaust fumes.

Now have each student compute his own commuting costs, those of a parent, or those of the "typical worker" at a nearby industry. An answer sheet is provided.

Additional Resources:

Free class copies of current gas mileage guides from U.S. Department of Energy, Fuel Economy Distribution, Office of Administrative Services, Washington, DC 20585.

Federal Highway Department Statistics from U.S. Department of Transportation, 400 Seventh Street, SW, Washington, DC 20590.

Background:

Some people do it to save money. Some do it to conserve energy. Some enjoy the companionship during an otherwise lonely time of day. Some are in it strictly for the ride. These are the car poolers who share the daily commuting on a voluntary basis. And these are also the van poolers who pay to ride in a company-sponsored vehicle.

At least 150 major corporations around the country operate vans to transport employees to and from work (according to the Wall Street Journal, Jan. 23, 1979). Commuters say they save \$1-\$3 per day in travel expenses by van pooling. It reduces wear and tear on autos, and lowers the expenses of parking and fuel. Some commuters also get reduced auto insurance rates because they no longer drive to work.

Companies say that van pooling boosts employee morale, reduces absenteeism, and avoids the expense of providing individual parking places for employees. The vans usually pay for themselves, too. Fares are set on a mileage basis that takes into account the original cost of the van, less its resale value, along with fuel, insurance, taxes, and maintenance expenses over the three to four year average use. Drivers who set up their own carpools can make similar estimates in order to charge each rider a fair share.

Procedure:

Using the following figures (or up-to-date ones, as available), have students figure the costs of driving to and from school:

STUDENT WORKSHEET

Name _____

Carpooling Cost Estimates

- Multiply cost per mile x miles per day:
 $\text{_____} \times \text{_____} = \$ \text{_____}$
- Add daily parking cost
 $\text{_____} + \text{_____}$
 Daily cost TOTAL:

- Multiply daily cost by number of school (working) days per month
 $\text{_____} \times \text{_____}$
 Lone driver's monthly cost TOTAL:

- Divide monthly cost of driving alone by number of people in carpool
 $\text{_____} \div \text{_____}$
- New cost per person by carpooling
 $\text{_____} - \text{_____}$
- Monthly carpool savings, #1 - #5
 $\$ \text{_____} - \$ \text{_____} = \$ \text{_____}$
- What other differences (besides personal savings) might carpooling make in your life?

Energy Action in Schools

6-adult

LIFESTYLE INDEX, 1977

A resource book, 32 pages

Grades 6-adult

Available from:

Citizens Energy Project

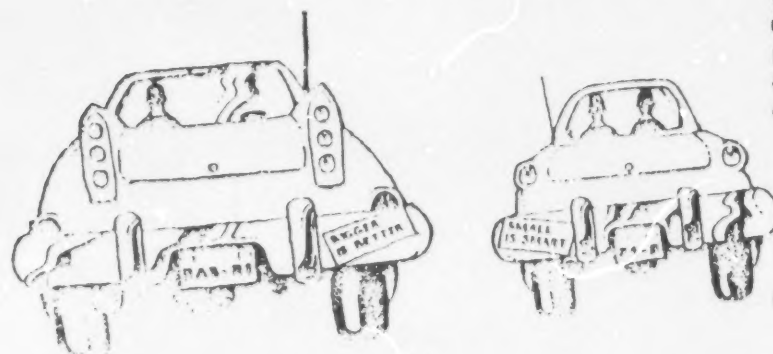
1110 6th Street N. W.

Washington, D. C. 20001

(202) 289-4999

Cost: \$2.50

The Lifestyle Index gives a wealth of information for a small price. It contains page after page of numbers for estimating how much energy a person uses for food, housing, clothing and personal care, transportation, and social and government sources. This is a fascinating resource to use for compiling a profile of individual energy consumption and illustrates all the ways we indirectly consume energy. Guaranteed to provoke discussion.



ENERGY BILLING

A chart based on Input-output traces the flow of energy through the economy. (See Table 3) It begins with energy entering the system from all primary sources: fossil fuels, nuclear, geothermal and hydro. This must, of course, include the energy to obtain the fuels so fossil fuels are multiplied by a factor of 1.1 as they are dispersed through the economy.* Electricity is considered to be a secondary energy source, with 78% of it coming from fossil fuel outputs. Add to the fossil fuel costs the energy used in making generation and transmission equipment as well as generation and transmission losses. The factor needed to balance inputs and outputs here is 3.68. So all electricity users must incorporate this factor. The flow continues to trace this energy through the consumer product life cycle as shown on p.6. Energy diverted to consumer services is also included along the path.

The figures are, as far as possible, based upon 1974 values. Where other figures had to be used they were adjusted to 1974 on the basis of personal consumption expenditures. The chart, then, while it applies only to a given year indicates where we are, how we got there, and hopefully areas where changes can be made. On the two following pages a billing is compiled which shows how U.S. citizens on the average are assessed for their share of the energy. Ultimately all energy must be attributed to the consumer.

* A packet of worksheets are available. The calculations to obtain this factor are included. \$5.00.

Energy Action in Schools

FROM ENERGY RESOURCES, INC.

JANUARY 1 19 77

TO MR. AND MS. AVERAGE AMERICAN

CITY ANYTOWN

TERMS ORDER IN ADVANCE ORDER NO.

Residence Expenses				
Home Food Preparation				
Direct	380			
Indirect	53			
Home Heating & Cooling				
Direct	1626			
Indirect	228			
Home Communications				
Direct	99			
Indirect	14			
Personal Travel(Fuel)				
Automobile				
Direct	1519			
Indirect	167			
Air, civilian				
Direct	159			
Indirect	17			
Bus				
Direct	22	7		
Indirect	2	3		
Railroad				
Direct	8			
Indirect	1			
Recreational Vehicles	20			
Lubricants, Antifreeze	36			
Other (subway, etc.)	27			
Construction				
Lumber	75			
Wood Products	3			
Paperboard	25			
Plastics	71			
Paving Asphalt	140			

Roofing (asphalt and other	43			
Foams	2			
Glass	21	5		
Stone, Cement, Concrete	238			
Mobile Homes	10			
Primary Metals				
Steel	114	5		
Aluminum	42			
Copper	3			
Zinc, etc.	4	5		
Fabricated Metals	48			
Tools	2			
Heat Controls	31			
Machinery	30			
Electrical	21	5		
Commercial Supplies	7			
Construction Contractors				
Direct	242	9		
Indirect	34			
Finance	10	6		
Consumer Items (purchased directly)				
Food and Beverages	904			
Tobacco	26			
Textiles and Apparel*	324			
Furniture	54			
Paper*	54			
Printed Matter*	126			
Chemical Based Items*	134			
Rubber Items	16			
Plastic Items	58			
Leather Goods	45			
Glassware	26			
Cutlery	9			
Misc. (prim., fab. metal)	13			
Hand Tools	9			
Power Tools	1			
Appliances	89	8		
Travel Vehicles*	502			
Watches	2			
Photography	9			
Miscellaneous*	80			
Recreation	55			

Vehicle Accessories				
Tires	104			
Batteries	10			
Radios	4			
Containers	5			
Commercial				
Finance, etc.				
Personal Finance	15			
Real Estate	36			
Legal	5	2		
Business	9	2		
Education and Medicine	344			
Governmental Services	644	5		
Lodging and Personal	212			
Auto Repair	72			
Recreation	31			
Water and Sanitation	16			
Electric and Gas	20			
Communication (telephone and telegraph)	67			
Radio and Television	25			
Postal	35	5		

The above billing would have to be sent to every man, woman, and child in the U.S. to total our energy consumption. After you have gone through all the individual sections, come back and make out your personal bill.

* These entries are further itemized at other places in the text.

The measure, Energy Units, abbreviated EU, is one of our own devising. One EU equals one ten-thousandth of the average amount of energy consumed by each person in the U.S. per year. The average amount of energy consumed by each person in the U.S. every year is 100,000 kwh, 343,000,000 Btu, or 10,000 EU. Therefore 1 EU is approximately equal to 10 kwh or 34,300 Btu.

Energy Action in Schools

10-12 to adult

THE SOLAR SELF-HELP BOOK

Adult Resource Book, 1979

Grades 10-12 to adults

Available from:

Southwest Research and Information Center

P. O. Box 4524

Albuquerque, NM 87106

(505) 262-1862

Cost: \$4.00

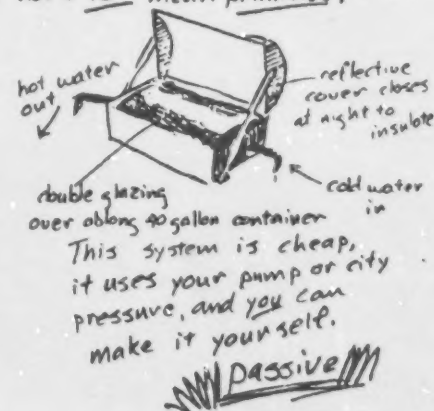
The best description of this solar handbook lies in its own "self-help" title. Designed to encourage the layman/woman to experiment with a range of solar heating/cooling options, this workbook specializes in simplistic construction. Suggestions progress from planting, and insulating, to building windows and vents, to constructing small greenhouses and solar heating systems. Handwritten constructions 'recipes' and illustrations reinforce the novice's confidence and add occasional touches of comic relief.



This book is about passive systems. They are not dependant on electrical outlets. A balance between active and passive systems seems to be a good option. Design around passive ideas and use fans, or whatever (active components) to help it along. Passive design utilizes high technology in the manufacture and transportation of materials, but is low technology once on the house. Passive does not mean primitive.



There are also large and expensive active systems for space heating. Mucho dinero!



DOE-DOE Bird

migrated from Washington years ago.

Likes to sit on passive air vents all day.

Very fat - hardly can fly.

Eats a lot but does nothing but pass it out.

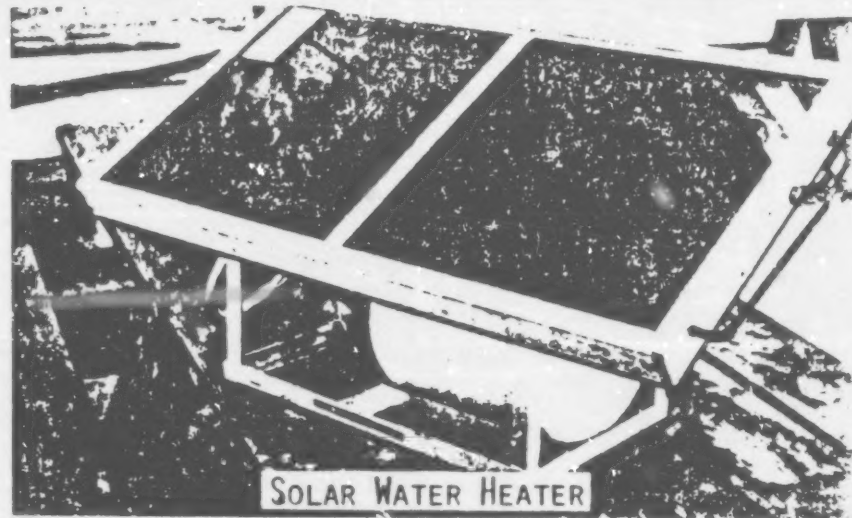
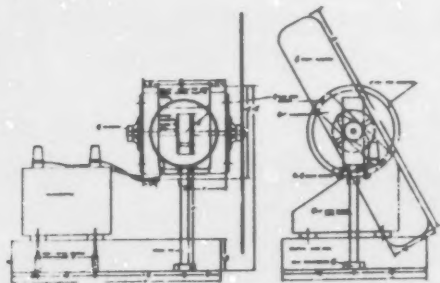
Energy Action in Schools

7-12

INDUSTRIAL ARTS MANUAL TO THE CONSTRUCTION OF MINIATURIZED ALTERNATIVE ENERGY SOURCE EQUIPMENT, 1978
Teacher's Guide and Duplication Masters
Grades 7-12

Available from:
Energy Management Center
P. O. Box 190
Port Richey, Florida 33568
Contact: Carol Snell
(913) 848-4870
Cost: \$12.00

Designed for junior high, high school, or vocational classes, this training manual consists of building instructions, blueprints, photos and materials lists for seven construction projects. Each miniaturized alternative energy unit explains a solar, wind or water concept and once completed, can be used for demonstration. Classroom guide-masters for duplication are included. Excellent to use in conjunction with other Energy Management Center curriculum.



I would like to order the Industrial Arts Manual to The Construction of Miniaturized Alternative Energy Source Equipment. \$12.00 each, payable in check or money order to the Energy Management Center.

☐ I would like information about the Validated ESEA IV/C project for elementary grades.

Name _____

Address _____

City _____

State _____ Zip _____

Phone _____

School District _____

Energy Action in Schools

10-12

KILOWATT COUNTER: A CONSUMER'S
GUIDE TO ENERGY CONCEPTS, QUANTITIES
& USES, 1975

Student Workbook, Grades 10-12, 36 pp.

Available from:

Alternative Sources of Energy

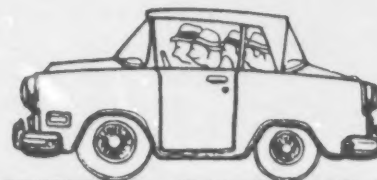
Rte. 2, Box 90A

Milaca, MN 56353

(612)983-6892

Cost: \$2.00.

Kilowatt Counter is a tool for making informed decisions regarding our individual buying habits, energy consumption and conservation, and environmental responsibility. Explanations and problems concerning energy measure and comparison thoroughly re-educate consumers who've been taught to take energy for granted. An energy awareness post-test and reading suggestions are provided in the concluding chapter.



Problem: Five friends decide to take a car pool to work, instead of driving separately. Driving alone each would travel an average of 15 miles per day, with an average gas consumption of 16 miles per gallon. Car pooling, the average route is 17 miles per day (longer to pick them up and let them off) with the average gas consumption of 15 mpg (because a larger car is used). How much gas and energy, in kwh, is saved? What was the energy cost per person of getting to work, alone and pooling, calculation for one year, five days a week, with six weeks off (230 days)?

Answer: Driving alone: 15 miles per day x 230 days/yr = 3,450 mi/yr. With a mileage of 16 mpg, we get 3,450/16 = 215.6 gal/yr per person or 5 x 215.6 = 1,078 gal/yr for all 5 people. The energy used is 215.6 gal/yr x 38.3 kwh/gal = 8,257 kwh/yr per person or 5 x 8,257 = 41,287 kwh/yr for all 5 people.

Car pooling: 17 miles per day x 230 days/yr = 3,910 miles/yr. At 15 mpg, we get 3,910/15 = 260.7 gal/yr for all 5 people or 260.7/5 = 52.1 gal/yr/person. The energy used is 260.7 gal/yr x 38.3 kwh/gal = 9,985 kwh/yr for all 5 people or 9,985/5 = 1,997 kwh/yr/person.

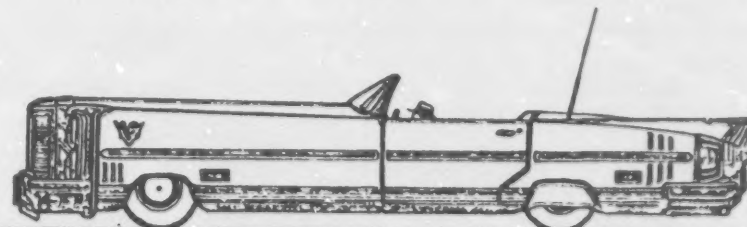
The overall savings in gallons of gas and in kilowatts of energy are then:

	Gas Used	Energy Used
Driving Alone:	1,078 gal/yr	41,287 kwh/yr
Car pooling:	52 gal/yr	1,997 kwh/yr
Savings:	817 gal/yr	31,302 kwh/yr

The savings in gallons of gas and kilowatts of energy per person are:

	Gas Used	Energy Used
Driving alone:	216 gal/yr	8,257 kwh/yr
Car pooling:	52 gal/yr	1,997 kwh/yr
Savings:	164 gal/yr	6,260 kwh/yr

At 60¢ a gallon, that's a savings of \$98.40 per year per person, not counting operating costs on the other autos. (It costs, according to the AAA, 23.2¢ per mile to own and operate a full-size U.S. car in a "high cost" area, and 16.4¢ per mile in a "low cost area.")



Energy Action in Schools

9-12

ENERGY AND ORDER

Activities guide, 42 pages

Grades 9-12

Available from:

Friends of the Earth

Book Dept.

124 Spear Street

San Francisco, CA 94111

(415) 495-4770

Cost: \$3.50 non-members

3.00 members

Tax - add 6%

Shipping - add 10%

Though the experiments in this booklet are designed to raise the energy consciousness of high school students, we recommend them for the upper elementary grades as well. Innovative and clearly written, each experiment gives the student a visual picture of an energy concept using everyday, familiar tools and settings. This unit is structured to first develop the student's energy vocabulary for confident use of power measurements and then develop a sense of energy order and relationships.

VIII. Understanding What's In the Container Container An Activity

This activity is designed to demonstrate how energy and food are interconnected, in both a technical and an economic sense and to provide some concrete examples of the inefficiency of American agriculture and the scale of the world food situation. "Watch Out, MacDonald's!"

This is to be conducted in a manner parallel to "Understanding What's on the Bill," but does require the use of some simple weighing apparatus. If metric equipment is unavailable, all of your figures can be converted using these equivalents: 0.45 kg/lb; 28g/oz.

Students are asked, in advance of this class period, to bring in one or two packaged foods from home. Emphasis is on examples of over-packaging. An analysis of the foods and their packaging is then conducted. We find it helpful to demonstrate the entire procedure for the whole class using a can of Pringles Potato Chips, our favorite example. (Apparently it is necessary to use paperboard, plastic, and aluminum to raise the price of a pound of potatoes from 10 cents to \$1.50.) To avoid wasting any of the food during the activity have various other clean containers handy.

I. Understanding What's in the Container

- What is the net weight of the food?
- How many Calories/unit of weight does the food contain?
- How many Calories are provided by the food in the container, total? (Occasionally this information is provided on the package. In other cases it is necessary to weigh the food and to take Calories/gram figures from a Calorie chart.)

II. Understanding What's in the Container!

- What is the nature of each kind of packaging making up the container?
- What is the weight of each component of the container?
- What is the energy used per unit of weight for each component?
- What is the total number of Calories used in manufacturing the container? (Here we rely on figures derived from many sources. See especially *Energy and Food*, Fritsch, et al.)

Conversion Factors for Packaging Materials -- Throwaways

Paper, Cardboard:	6,000 Calories/kg
Steel, Bi-metal:	12,000 Calories/kg
Aluminum:	64,000 Calories/kg
Glass:	7,500 Calories/kg
Plastic:	3,500 Calories/kg

III. Understanding the Difference

- Calorie Content of Food, Total _____
- Calorie Content of Container, Total _____
- Total Calorie Content of Item _____
- Fraction Representing Food Calories/Total Calories _____
- % of Total Energy in Item that is Food Energy _____

IV. Why Recycle What You Could Return?

- Recycling of most materials represents about a 10 percent energy savings. If all materials in the container were recycled, what would be the Total Energy Content of the Container?
- Returnability of glass and some plastics saves as much as 75 percent. Using the chart below, calculate the Total Energy of the Container if it were made entirely of returnable glass or returnable plastic

Energy Content of Glass Returnables =

Glass Throwaways X .2
Paper Throwaways X .50
Steel Throwaways X .35
Aluminum Throwaways X .30
Plastic Throwaways X .60
Plastic Returnables = Plastic Throwaways X .40

Discussions following this activity inevitably revolve around the nature of waste, the manner in which tastes are shaped by advertising, and the estrangement of most Americans from the sources of their foods. At this point, we also try to resurrect the Calorie from the ashes of the weight watchers' fires. There is generally a strong bias against Calories among our students. It is worthwhile to break down this bias and examine its origins. After all, energy in food is essential to life, and Calories are nothing more than units that allow us to measure energy. Why does a society go to such lengths, in fact use so much energy, to fabricate and package materials designed to have no energy content but to be sold as food? What right does a society have to do this in light of the world food situation?

EnergyAction in Schools

7-12

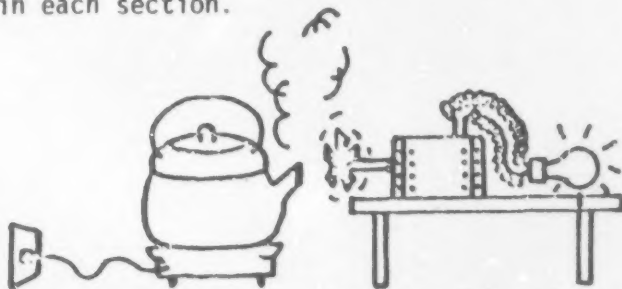
ENERGY MANAGEMENT STRATEGIES FOR
HOME ECONOMICS TEACHERS, 1981
Teacher's guide & student materials
Grades 7-12

Available from:

Georgia Doherty
Public Service Company of Colorado
550 15th Street, Room 676
Denver, CO 80202
(303) 571-7350

Cost: \$10.00 per single order
7.00 per copy w/25 min. order
+ shipping

A very thorough examination of energy reduction as it relates to the home. This teacher's manual outlines curriculum and student materials via a five-unit approach: Foods and Nutrition, Clothing and Textiles, Housing and Home Furnishing, Child Development, and Personal and Family Relations. Through a variety of exercises and activities each unit investigates home product energy use as part of the larger energy network. Resource bibliographies are included in each section.



what's for lunch - the soup or the can?

Definitions: Kilowatt (KW) One thousand watts
Kilowatt hour (KWH) One thousand watts on for one hour
Food calorie 0.0011627 KWH; 860 calories = 1 KWH

Container	Energy Cost of Beverage Containers				
	KWH for Production	Renewable	Reusable	Biodegradable	Recyclable
Returnable pop bottle (8 oz.)					
Nonreturnable pop bottle (8 oz.)					
Milk carton (8 oz.)					
Steel can (8 oz.)					
Aluminum can (8 oz.)					
Polyvinylchloride bottle (8 oz.)					
Glass package (8 oz.)					
Paper cup (8 oz.)					
Styrofoam cup (8 oz.)					
Mason jar (8 oz.)					



Comparison of Kilowatt Hours Contained in Food vs. Package

Returnable pop bottle (8 oz.)	KWH
Pop (Coca Cola), (8 oz., 98 calories)	KWH
Milk carton (8 oz.)	KWH
Milk (8 oz., 160 calories)	KWH
Steel can (8 oz.)	KWH
Tomato juice (8 oz., 45 calories)	KWH
Paper cup (8 oz.)	KWH
Coffee (8 oz., 1 calorie)	KWH

Energy Action in Schools

7-12

ENERGY: NEBRASKA HOME ECONOMICS

ENERGY MANAGEMENT GUIDE

Marge Hill Nickish, 1981

Teacher's curriculum notebook with
student materials

Grades 7-12 home economics students

Available from:

Nebraska Energy Office

State Capitol Building, 9th floor

P. O. Box 95085

Lincoln, NE 68509

(402) 471-2867

Cost: \$12.00

The Nebraska Home Economics Energy Management Guide is a very useful guide for home economics teachers. Included in the guide are teacher lesson plans on how to lead a more energy efficient homelife, through wise and practical energy management measures. Lessons are included on housing, foods, clothing, and family. A resource section contains thermofaxable student visuals, and a bibliography. The guide is very informative and well written.



Housing

HHF#6

(Visual Fig. #3)

Apartment Case Study

From the information provided, evaluate the two apartments described in the case study below. You may be able to use your Apartment Energy Checklist to help you compare the disadvantages and advantages of the two apartments. The two units are of comparable size and comparable rent.

Case A — First floor apartment in 4-apartment building (another apartment above, another beside). Heated basement. Double entry door. Storm windows. Some weatherstripping. No caulking. Large picture window and door to building face north. Apartment has steam heat provided by fuel oil. Apartment building has central air conditioning. All utilities are included in the rent. Faces street. Building is four years old. Two young pin oaks have been planted near the sidewalk, otherwise little landscaping.

Case B — Apartment is entire first floor of house. Another apartment above. Basement is unheated. Single entry door faces south. Room air conditioner is in the south window. Large weeping willow tree shades south side of house in summer. House is 30 years old; insulation is commensurate with the age. Landlord has caulked and weatherstripped. Storm windows are provided. Apartment has hardwood floors throughout except the kitchen and bath. Kitchen and bathroom have linoleum floors. Windows are furnished with sheer curtains. Renters pay own utilities. Heat is provided by natural gas; separate meters exist for each apartment.

1. Based on your evaluation, which apartment is probably more energy efficient? Why?
2. What could be done to make apartment A more energy efficient?
3. What could be done to make apartment B more energy efficient?
4. If you rented apartment A what energy-saving steps would you pursue first? Why?
5. If you rented apartment B what energy-saving steps would you pursue first? Why?

Energy Action in Schools

11-12 and post-secondary

ENERGY EFFICIENCY: YOU MAKE THE DIFFERENCE, 1982

Vocational education student directed modules

Grades 11-12 and post-secondary

Available from:

The published form will be available in March, 1982. Contact EAIS or

American Institutes for Research

P. O. Box 1113

Palo Alto, CA 94302

A.I.R. (415) 493-3550

Cost: To be determined

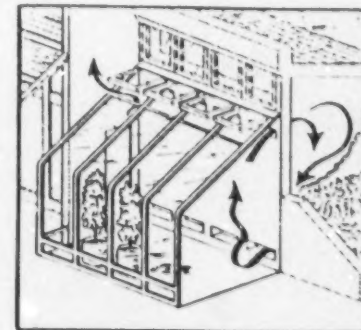
Energy Efficiency: You Make the Difference is a valuable curriculum resource for vocational and R.O.P. educators. Student directed booklets are clearly written and provide students with timely conservation information. EAIS has a sample of the modules, contact us, or A.I.R. for further information on availability. The contents are as follows:

1. Energy Efficiency: The Big Picture begins with an overview of the current energy situation and of our renewable and non-renewable energy resources. It defines conservation as a source of energy and tells how energy efficiency can create more jobs and encourage high productivity.
2. Energy Efficiency for Businesses and Homes describes what businesses and individuals are currently doing to become more energy efficient. It presents the corporate and individual benefits of energy conservation at home and at work.
3. Learning Activity Package materials are designed to help students perform a simple energy survey of their school. By conducting this survey, students will learn to analyze how energy could be used more efficiently in schools, businesses, and homes.

4. Energy-Use-and-Conservation Activities identify and describe a number of energy conservation projects that can be done by student groups outside of the classroom.

5. Occupation Specific Modules discuss on-the-job worker behaviors designed to save energy.

Nurses
Greenhouse Workers
Field Crop Farmers
Food Service Workers
Child-Care Workers
Homemakers
Secretaries and Word Processing Operators
Office Managers
Hotel, Motel, and Residential Property Managers
Retail Store Managers
Restaurant Employees
Foodstore Employees
Bus, Truck, and Taxi Operations Managers
Electronics Technicians
Engineering and Industrial Technicians
Architectural Technicians
Boiler Operators and Stationary Engineers
Auto Mechanics
HVAC Specialists
Machinists and Tool-and-Die Makers
Plant Supervisors
Carpenters



- The ideal use of windows and glass (glazing) depends on the climate where the building is located. In most parts of the United States, it is a good idea to do these things:

- (1) Place most large windows on the south and east sides of the building and few, if any, windows on the north and west sides. South-facing windows collect three times as much heat in winter as west-facing windows. Also, they do not collect too much heat late in the day in summer when the heat is not wanted.
- (2) Attach a solar greenhouse to the south wall. Heat collects in a heavy masonry wall, a pool, or in water-filled heat collectors in the greenhouse. Floor and ceiling level vents (sometimes fan-assisted) control the transfer of heated air from the greenhouse to the living space. A solar greenhouse can supply as much as 30 percent of a home's heating requirements.

One family in Seattle, Washington, remodeled their large home so that the entire south wall formed a large solar greenhouse. After they built the greenhouse, their winter heating bills came to \$400, compared to \$1300 the year before.

EnergyAction in Schools

11-12

PROVIDING FOR ENERGY EFFICIENCY IN HOMES & SMALL BUILDINGS: Parts I, II, III II, III

Teachers Guide, Student Workbook
Student Information and "how to"
manual

Grades 11-12 Vocation Education,
ROP, Industrial Arts

Available from:

U. S. Dept. of Energy
Technical Information Center
P. O. Box 62

Oak Ridge, Tennessee 37830
(615) 576-1306

Cost: Single copies are free

This very complete student-teacher book covers everything from what the U. S. energy situation is presently, to, how an air conditioner works. A student curriculum and teachers guide are included, which provide valuable information and materials for a high school level class. The first three manuals provide a laymans' guide on "how to" make a building energy efficient. The drawings are clear, the readability and the information is complete.

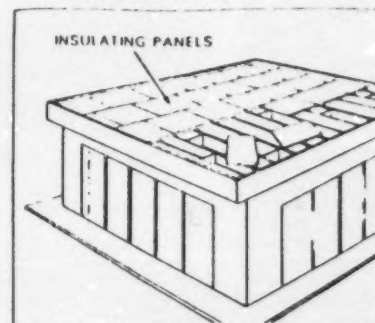


FIGURE 88. Styrofoam and compressed organic fibers come in rigid sheets.

Insulating panels of styrofoam, polyurethane and compressed organic fibers are effective materials when placed in proper locations in buildings (Figure 88). These panels are commonly used on flat roof decks being put in place before the final roofing.

They may also be added to the outside walls.

Flexible insulation is available in blankets and batts. These, too, may be of mineral wool, wood fibers, or fiberglass and come in varying thicknesses (Figure 89). Standard widths are 41 and 61 cm (16 and 24 in). Batt insulation is installed between exterior wall studs and ceiling joists in residences during construction.

5. EFFECT OF VAPOR BARRIERS

As warm air comes in contact with a cooler surface, such as walls and window panes, water vapor in the air condenses on the cooler surface. When insulation is used in walls and ceilings, moisture can condense on the inside surface of the insulation if an extreme temperature difference exists between the room and the outside. If this moisture works its way to the insulation, the insulation becomes a conductor of heat and loses

much of its value. To prevent the passage of moisture from the interior of the room to the insulation, a vapor barrier is desirable. This vapor barrier is simply a layer of non-porous paper, plastic, or aluminum foil on the inside surface of the insulating material (Figure 90). Should moisture collect on the vapor barrier, it cannot pass through to the insulation and it eventually evaporates into the room. Thus the insulation in the wall remains dry and effective.

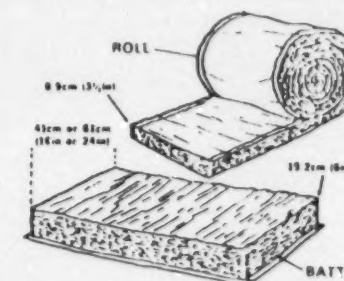


FIGURE 89. Insulation batts or fiberglass.

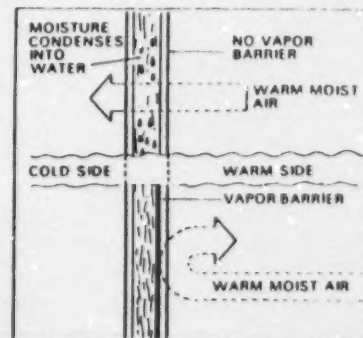


FIGURE 90. A vapor barrier is used to prevent condensation of water on the cool side of your house.

EnergyAction in Schools

10-12

SOLAR ENERGY EXPERIMENTS FOR HIGH SCHOOL AND COLLEGE STUDENTS

By Thomas W. Norton, 1977

Grades 10-12

Available from:

Rodale Press

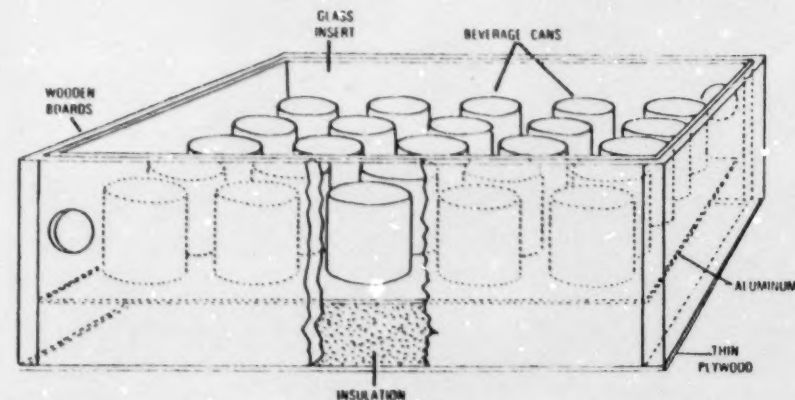
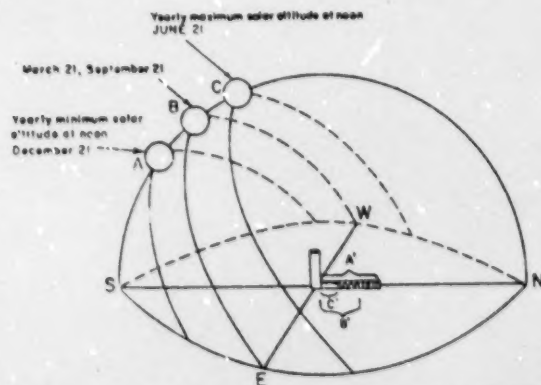
33 East Minor

Emmaus, PA 18049

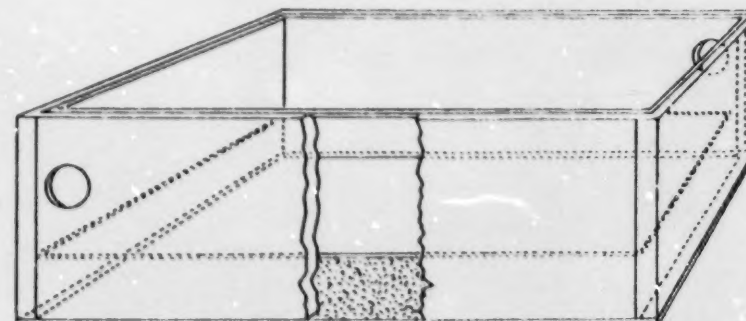
(215) 967-5171

Cost: \$5.95

These solar experiments for the advanced physics class involve measuring and using data. Each experiment has a structured format including an objective, introduction, description of materials and procedure. Some of the experimental apparatus can be assembled at home, but most experiments require a well equipped school laboratory. Contains a useful appendix of glossary terms, conversion factors and other necessary data tables.



Hot air collector with and without discarded beverage cans.



Energy Action in Schools

11-12+ physics

A LAB MANUAL FOR THE STUDY AND MEASUREMENT OF CONDUCTION HEAT LOSS

By Richard N. Lohman, Albany H. S.
1981

Student Activity Manual

Grades 11-12+

Available from:

Dr. David Stern

School of Education

U. C. Berkeley

Berkeley, CA 94720

(415) 642-0709

Cost: Limited numbers free to
educators

Ten step-by-step activities provide students with both a theoretical and practical understanding of basic heat loss calculations. In each activity; a statement of theory is made, examples are shown of its application, problems are suggested to reinforce the understanding and lab experiments are used to demonstrate theories. Teachers of both physical sciences and subjects related to building construction will find this a valuable curriculum supplement because the activities present heat loss concepts sequentially in a clear and understandable format.

ACTIVITY #4: Measurement of R-Value of Air Spaces

Purpose: To show that the R value of air spaces changes very little from $\frac{1}{2}$ " up to 4".

Materials: Insulated box with associated equipment used in Activity #3

Theory: (See Activity #3)

According to Appendix I, the R value of an air space where heat is moving horizontally is the same for a space of $\frac{1}{2}$ " or a space of 4". In this activity the above fact will be verified.

Activity:

- 1) Set up the sixth wall of the insulated box with two pieces of $\frac{1}{2}$ " plywood separated by a $\frac{1}{2}$ " air space.
- 2) Proceed as in Activity #3 to measure the R-value of this arrangement. In this case you do not need to subtract the air film values.

3) Record the data below:

$T_{in} = \text{_____}^{\circ}\text{C}$ $T_{out} = \text{_____}^{\circ}\text{C}$

volts = _____ amps = _____

length = _____ width = _____

4) Calculate:

$$R_{(1/2)} = \frac{L \times W}{\frac{\text{volts} \times \text{amps}}{T_{in} - T_{out}} - E.F.}$$

5) Now change the air space to 3" or 4" and repeat the measurements. Record the data below:

$T_{in} = \text{_____}^{\circ}\text{C}$ $T_{out} = \text{_____}^{\circ}\text{C}$

volts = _____ amps = _____

6) Calculate:

$$R_{(3)} = \text{_____}$$

7) Compare your answers in 4) and 6)

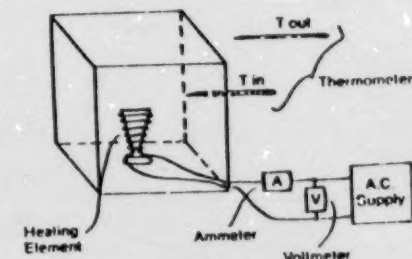
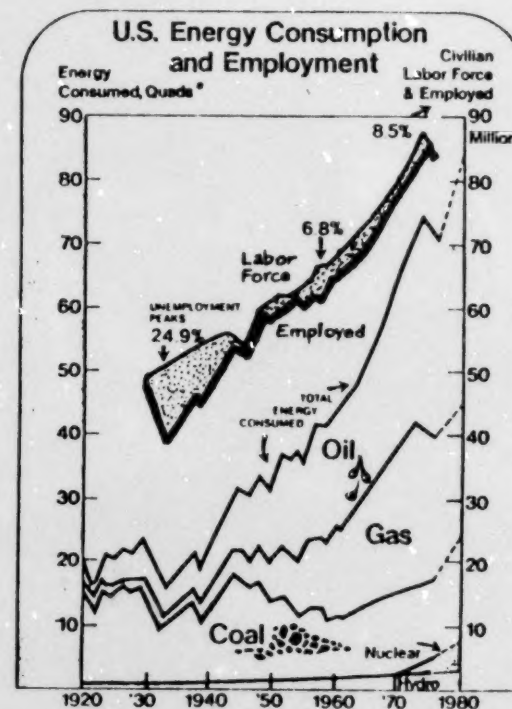


FIGURE 3

ENERGY INFORMATION RESOURCE KITS, 1980
Teacher's Guide & Student Materials
Grades 10-12
Available from: Many utilities
Cost: Free from many utilities.
5 kits (booklets):
Energy Issues in the 1980 Elections
Global Perspectives on Energy
Energy and the Economy
Science and Engineering Careers in Energy
Conservation for Citizens & Customers

These five separate kits furnish ample background information on current energy issues. Each kit presents a variety of views on one energy topic via class discussions, articles on policy options, graphs and charts, and open-ended group projects. A good stimulus for out-of-class explorations and research; the kits are also valuable as career information sources.

JOBS AND ENERGY: THE WORKING RELATIONSHIP



It is misleading to judge the employment potential of an energy source solely on the basis of the number of people employed in its production. Equal consideration must be given to the nature of the jobs involved in the process and the quality and quantity of the jobs generated.